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ENVIRONMENTAL AND EXPLORATION PROGRAM

SUMMARY REPORT #3
(Through May 31, 1975)

C-b SHALE OIL PROJECT

Ashland Oil, Inc.
Atlantic Richfield Company
Shell Oil Company, Operator
The Oil Shale Corporation

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U. S. DEPARTMENT OF THE INTERIOR

PROTOTYPE OIL SHALE LEASING PROGRAM

TRACT C-b

SUMMARY REPORT #3

(Through May 31, 1975)

Submitted to:

Mr. Peter A. Rutledge
Area Oil Shale Supervisor
Conservation Division
U. S. Geological Survey
Grand Junction, Colorado

By:

C-b Shale Oil Project

Ashland Oil, Inc.
Atlantic Richfield Company
Shell Oil Company, Operator
The Oil Shale Corporation

1700 Broadway
Denver, Colorado 80202

July 15, 1975

TRACT C-b
SUMMARY REPORT #3
(Through May 31, 1975)

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INTRODUCTION

Summary Report #3 and Quarterly Report #3 cover the third quarter of exploration and environmental data for the first year of the Environmental Baseline Program. These reports specifically cover the spring quarter of March, 1975 through May, 1975. Quarterly Report #3 consists of 18 volumes of a comprehensive compilation of data submitted to the Area Oil Shale Supervisor in Grand Junction on July 15, 1975. Parties interested in reviewing the comprehensive data may contact the Area Oil Shale Supervisor's Office. This Summary Report #3 is intended only to provide the reader with a general overview of the information included in the Quarterly Report #3. For a complete summary of on-Tract activities to date, reports from all three quarters must be consulted.

The fourth quarterly report and summary report, which will essentially cover the fourth quarter of the first year's collection of baseline data, will be submitted to the Area Oil Shale Supervisor's Office prior to the submittal of the Detailed Development Plan. All of the first year's data will be collected before submitting the Detailed Development Plan.

Effective June 1, 1975, the role of Operator for the Lease was transferred from Atlantic Richfield Company to Shell Oil Company. The Venture partnership remains unchanged and only the role of active Operator has been reassigned. This change will have no effect on the continuity of the exploratory and environmental programs and no change in operating philosophy is planned. The C-b Shale Oil Project remains committed to a program to ensure that the prototype oil shale program will develop with a thorough understanding of the environmental effects resulting from shale oil production. Most of the personnel associated with the Tract C-b environmental programs will continue in their assignments with the new operating company.

I

PRE-EXPLORATION ENVIRONMENTAL RECONNAISSANCE SURVEYS

Pre-exploration environmental reconnaissance surveys conducted during previous quarters cover activities which took place on Tract C-b during this quarter, such as preparation of drill pads and corehole drilling of slant holes. The results of these surveys are contained in Quarterly Reports #1 and #2, and are summarized in Summary Reports #1 and #2. The report on the archaeological reconnaissance investigation of the site for corehole SG-22 has not yet been received. Work on this corehole is not planned for the near future, and will not be initiated until this reconnaissance is satisfactorily completed.

II

ENVIRONMENTAL BASELINE MONITORING PROGRAMS

II A SURFACE WATER

II A-1 Surface Streams

During the third-quarterly report period, water samples were reported from eight of the thirteen stations on and near Tract C-b. The locations for all 13 stations are shown on Figure II A-1. The stations where water quality data were obtained this third quarter are identified by circles on Figure II A-1 and are as follows:

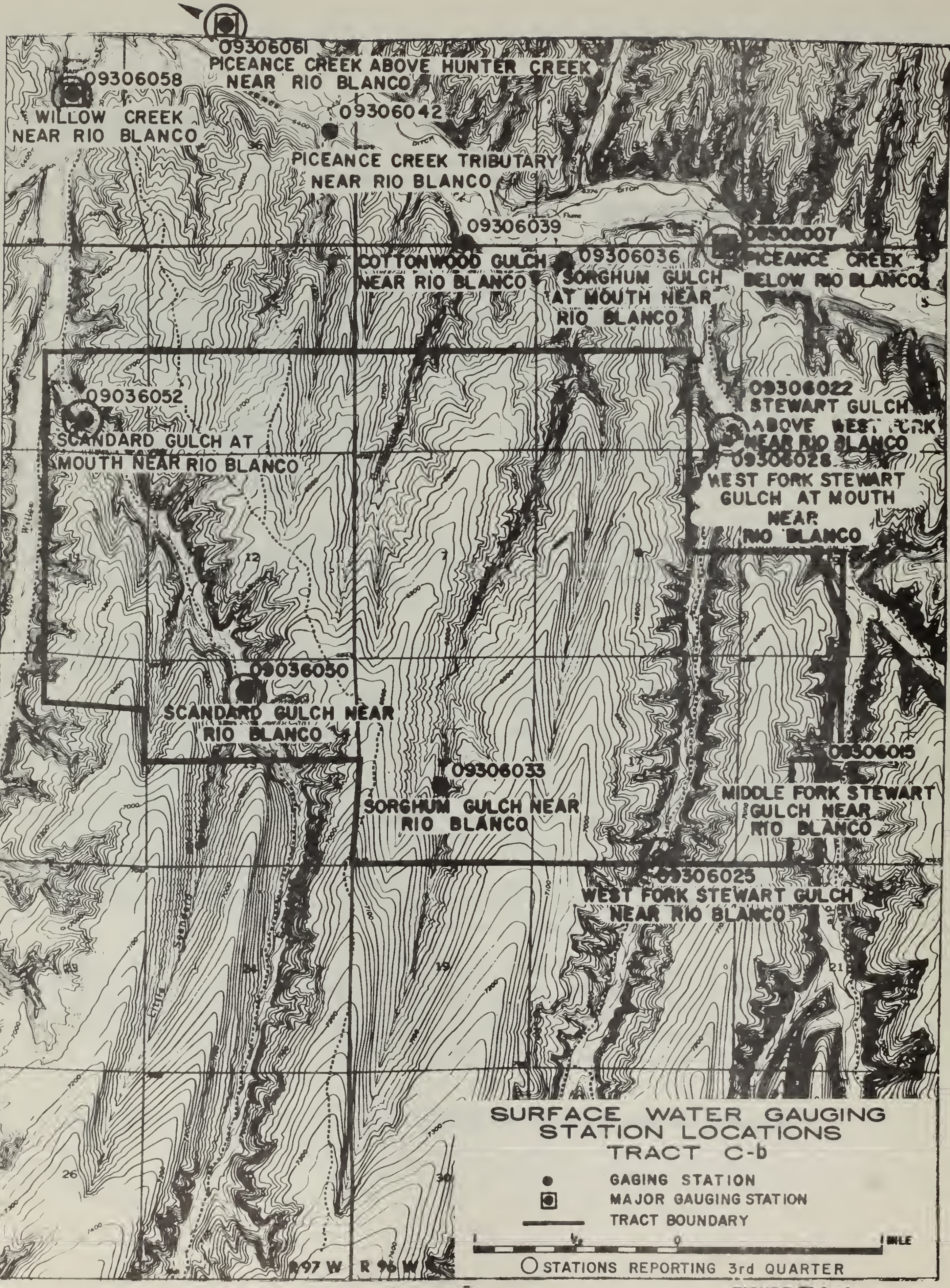
U.S.G.S. 0936025	U.S.G.S. 0936007
* U.S.G.S. 0936030	U.S.G.S. 0936022
U.S.G.S. 0936050	U.S.G.S. 0936058
U.S.G.S. 0936052	U.S.G.S. 0936061

Those in the second column are located on perennial streams and are classified as major gauging stations. The remaining stations are on ephemerical streams and data are obtained only during a precipitation event large enough to cause a recordable flow in the channel.

Comparison of the results of major constitutent analysis in the USGS's laboratory and in The Oil Shale Company's (TOSCO) laboratory is shown in Table II A-14. The comparison between the two laboratories is excellent. A summary sheet for water quality is given for each station for each date a water sample was collected during the present quarterly reporting period or during the last quarter but not reported in *Quarterly Report #2*. The number of constituents in the summary sheets does not correspond with the number of constituents reported by the U.S.G.S. Laboratory. Beginning with this *Quarterly Report #3*, the summary sheets have been modified to contain information only on required constituents. They therefore differ somewhat from those sheets used in *Quarterly Report #2*. It should be pointed out that the units used vary from element to element; the unit used (milligram vs. microgram per liter) should be ascertained before any analysis of the data is made.

Inasmuch as the Water Quality Summary Tables are placed in this volume as a convenience to the casual reader, it should be pointed out that some elements may occur in such small quantities that their presence may go undetected. That is to say, the amount of a given element is less than the detection limits of the analytical method used.

* Formerly in the vicinity of 0936022; relocated in the fall of 1974.



SURFACE WATER GAUGING
STATION LOCATIONS
TRACT C-b

FIGURE II A-1

For example, if in two successive sampling periods the amount of barium analyzed in the U.S.G.S. Laboratory is reported as "<100" micrograms per liter and "<200" micrograms per liter, it should not be assumed that there was twice as much barium present on one occassion as there was on the other. There in fact may have been no barium present at all. The "less than" symbol, <, indicates that if barium existed in the water sample, its quantity was less than the stated amount and less than the dectable analytical limit.

The analysis of the sample collected for U.S.G.S. Station No. 0936058 on March 6, 1975 indicated a Gross Alpha determination greater than the level specified as requiring further testing, i.e., greater than 4 picocuries per liter. In such a situation it is required to analyze for Radium 226. This is being done by the U.S.G.S. Laboratory and will be reported in subsequent printouts.

Minimum, maximum and median concentrations for selected elements are reported in Tables II A-9 through II A-13.

Analysis of water quality information received to date will show that several elements being monitored on a bi-monthly basis are below existing U. S. Public Health Service limits and near the detectable lower limit of concentration. Bi-monthly monitoring of such elements would appear to be unnecessary with quarterly analysis providing sufficient information. These elements are listed below:

Concentration in Milligrams/Liter
(April 1974 - April 1975)

Element	Minimum	Maximum	Public Health Limit
arsenic	0	0.006	0.05*
barium	0	0.200	1.0*
cadmium	0	<0.020**	0.01*
chromium	0	0.020	0.05*
copper	0	0.020	1.0
cyanide	0	0.01	0.2*
lead	0	<0.020**	0.05*
lithium	0	0.056	***
mercury	0	0.0009	0.002
selenium	0	0.005	0.01*
zinc	0	0.370	5.0

* Drinking water standards--rejection of water supply if exceeded.

** A maximum reported as less than implies the lower limit of detectability for the analytical method used.

*** No standards set.

II A-2 Springs and Seeps

Samples were obtained from selected springs this past quarter for radiocarbon age determination. Two springs were analyzed for major constituents. The locations of springs in this report are shown in Figure II A-2. A summary of the water analysis can be found on Table II A-15. Data pertaining to the radiocarbon analysis follow on Table II A-16.

TABLE II-A-1

SURFACE WATER QUALITY
BASELINE DATA

BASELINE DATA TO BE
COLLECTED SEMI-MONTHLY

STATION: U.S.G.S. No. 09306007 Piceance Creek Below Rio Blanco
February 1975 - April 1975

	2/3	2/19	3/6	3/20	4/2									
1. Ammonia (mg/1) (Nitrogen)	.06	.07	.09	.03	.04									
2. Arsenic (ug/1)	5	1	2	4	2									
3. Barium (ug/1)	100	<100	200	<100	<100									
4. Bicarbonate (mg/1)	562	602	533	450	541									
5. Boron (ug/1)	190	220	220	220	240									
6. Cadmium (ug/1)	0	-	0	0	0									
7. Calcium (mg/1)	72	69	70	66	69									
8. Carbonate (mg/1)	0	0	0	32	0									
9. Chloride (mg/1)	19	17	15	16	15									
10. Chromium (ug/1)	0	-	0	0	0									
11. Color (PCU)	3	-	20	5	8									
12. Copper (ug/1)	1	-	2	1	1									
13. Cyanide (mg/1)	.00	.00	.00	.00	.00									
14. Fluoride (mg/1)	1.1	1.3	1.1	1.3	1.3									
15. Iron (ug/1)	20	60	90	10	20									
16. Kjeldahl Nitrogen (mg/1)	.61	.59	.86	.58	1.0									
17. Lead (ug/1)	6	-	3	2	1									
18. Lithium (ug/1)	20	-	10	20	20									
19. Magnesium (mg/1)	46	56	48	49	47									
20. Manganese (ug/1)	67	-	110	110	70									
21. Mercury (ug/1)	.1	--	.2	.0	.8									
22. Nitrate (mg/1) as NO_3	1.4	1.2	.97	.44	1.2									
23. Nitrite (mg/1) as NO_2	.03	.03	.03	.00	.00									
24. Odor	0	-	0	0	0									
25. Oil & Grease (mg/1)	6	10	6	3	3									
26. Ortho-Phosphorus (mg/1) (total)	.04	.04	.10	.03	.04									
27. Potassium (mg/1)	2.6	2.6	4.9	3.3	3.6									
28. Selenium (ug/1)	1	1	1	1	1									
29. Silica (mg/1)	16	16	14	12	14									
30. Sodium (mg/1)	130	130	120	120	120									
31. Solids, Dissolved (mg/1)	736	761	678	683	699									
32. Sulfate (mg/1)	170	170	140	160	160									
33. Sulfide (mg/1)	.1	.0	.2	.2	.2									
34. Turbidity (JTU)	10	80	20	20	130									
35. Zinc (ug/1)	20	-	10	20	20									
36. pH	9.0	8.5	8.0	8.5	8.5									

DATA TO BE OBTAINED QUARTERLY
AT FOUR MAJOR STATIONS

1. Complete Element Scan	-	-	-	-	-									
2. Radioactivity														
a. Gross Alpha (pcl) U Nat. Suspended	-	-	2.1	-	-									
Radium 226*														
b. Gross Beta Cs-137 & Sr90 Suspended	-	-	6.2											
Thorium 230**														
Uranium**														
3. Total Organic Carbon (TOC) (mg/1)	-	-	8.4	-	-									
If TOC> 10 mg/liter, then														
a. Nitrogen (Base Extraction)														
b. Organic Carbon, Dissolved														
c. Organic Carbon, Suspended														
d. Phenols														
e. Polycyclic Aromatics														
f. Sulfur (Acid Extraction)														
4. COD	-	-	35	-	-									
5. Coliform, Fecal	-	-	28	-	-									
6. Pesticides	-	-	-	-	-									

* Required if Gross Alpha> 4 picocuries per liter (pcl)
** Required if Gross Beta >1000 picocuries per liter (pcl)
N Non-Instantaneous Discharge

TABLE II A-2

SURFACE WATER QUALITY
BASELINE DATA

BASELINE DATA TO BE COLLECTED SEMI-MONTHLY

STATION: U.S.G.S. No. 09306022 Stewart Gulch Ab West Fork Nr Rio Blanco Co.
February 1975 - April 1975

	2/3	2/19	3/6	3/20	4/2
1. Ammonia (mg/1) (Nitrogen)	.06	.05	.03	.03	.01
2. Arsenic (ug/1)	3	1	0	2	0
3. Barium (ug/1)	<100	<100	<100	<100	<100
4. Bicarbonate (mg/1)	519	516	510	437	497
5. Boron (ug/1)	70	80	80	80	90
6. Cadmium (ug/1)	1	1	0	0	1
7. Calcium (mg/1)	98	93	95	97	95
8. Carbonate (mg/1)	0	0	0	38	0
9. Chloride (mg/1)	7.0	8.1	7.2	7.0	7.0
10. Chromium (ug/1)	0	0	0	20	0
11. Color (PCU)	3	3	20	8	0
12. Copper (ug/1)	8	3	2	1	3
13. Cyanide (mg/1)	.01	.02	.00	.00	.00
14. Fluoride (mg/1)	.4	.3	.3	.1	.3
15. Iron (ug/1)	10	10	40	20	30
16. Kjeldahl Nitrogen (mg/1)	.45	.65	.46	.80	.36
17. Lead (ug/1)	6	2	0	3	2
18. Lithium (ug/1)	10	20	20	10	10
19. Magnesium (mg/1)	78	76	81	86	74
20. Manganese (ug/1)	40	30	30	30	10
21. Mercury (ug/1)	.0	.0	.0	.0	.1
22. Nitrate (mg/1) as NO_3	8.4	7.9	7.9	8.0	8.0
23. Nitrite (mg/1) as NO_2	.03	.03	.03	.00	.00
24. Odor	0	0	0	0	0
25. Oil & Grease (mg/1)	9	8	7	4	3
26. Ortho-Phosphorus (mg/1) (total)	.18	.05	.06	.03	.02
27. Potassium (mg/1)	1.6	1.5	1.7	1.6	2.4
28. Selenium (ug/1)	1	1	1	1	1
29. Silica (mg/1)	16	15	15	14	15
30. Sodium (mg/1)	120	120	120	120	120
31. Solids, Dissolved (mg/1)	956	957	950	958	937
32. Sulfate (mg/1)	370	380	370	370	370
33. Sulfide (mg/1)	.1	.0	.1	.1	.2
34. Turbidity (JTU)	5	30	10	16	17
35. Zinc (ug/1)	20	60	20	30	20
36. pH	8.8	8.5	8.1	8.4	8.6

DATA TO BE OBTAINED QUARTERLY AT FOUR MAJOR STATIONS

1. Complete Element Scan					
2. Radioactivity					
a. Gross Alpha (pcl) Suspended U Nat.	-	-	1.7	-	-
Radium 226*					
b. Gross Beta CS-137 & Sr	-	-	4.5	-	-
Thorium 230**					
Uranium**					
3. Total Organic Carbon (TOC) (mg/1)	-	-	3.1	-	-
If TOC> 10 mg/liter, then					
a. Nitrogen (Base Extraction)					
b. Organic Carbon, Dissolved					
c. Organic Carbon, Suspended					
d. Phenols					
e. Polycyclic Aromatics					
f. Sulfur (Acid Extraction)					
4. COD	-	-	10	-	-
5. Coliform, Fecal	-	-	0	-	-
6. Pesticides	-	-	-	-	-

* Required if Gross Alpha> 4 picocuries per liter (pcl)
** Required if Gross Beta >1000 picocuries per liter (pcl)
N Non-Instantaneous Discharge

TABLE II A-3

SURFACE WATER QUALITY
BASELINE DATA

BASELINE DATA TO BE
COLLECTED SEMI-MONTHLY

STATION: U.S.G.S. No. 09306025 West Fork Stewart Gulch Nr. Rio Blanco Co.
November 1974

	11/6	11/20												
1. Ammonia (mg/l) (Nitrogen)														
2. Arsenic (ug/l)	1	2												
3. Barium (ug/l)	<100	<100												
4. Bicarbonate (mg/l)	488	757												
5. Boron (ug/l)	90	130												
6. Cadmium (ug/l)	1	1												
7. Calcium (mg/l)	82	130												
8. Carbonate (mg/l)	-	-												
9. Chloride (mg/l)	9.4	12												
10. Chromium (ug/l)	-	-												
11. Color (PCU)														
12. Copper (ug/l)	1	1												
13. Cyanide (mg/l)														
14. Fluoride (mg/l)	.2	.2												
15. Iron (ug/l)	210	20												
16. Kjeldahl Nitrogen (mg/l)														
17. Lead (ug/l)	3	11												
18. Lithium (ug/l)	0	0												
19. Magnesium (mg/l)	84	120												
20. Manganese (ug/l)	0	10												
21. Mercury (ug/l)	.0	.0												
22. Nitrate (mg/l) as NO_3														
23. Nitrite (mg/l) as NO_2														
24. Odor	0	-												
25. Oil & Grease (mg/l)														
26. Ortho-Phosphorus (mg/l) as P	.02	.02												
27. Potassium (mg/l)	3.1	3.7												
28. Selenium (ug/l)	5	0												
29. Silica (mg/l)	13	17												
30. Sodium (mg/l)	130	200												
31. Solids, Dissolved (mg/l)	943	1450												
32. Sulfate (mg/l)	380	590												
33. Sulfide (mg/l)														
34. Turbidity (JTU)														
35. Zinc (ug/l)	40	20												
36. pH	8.2	-												

DATA TO BE OBTAINED QUARTERLY
AT FOUR MAJOR STATIONS

1. Complete Element Scan	-	-												
2. Radioactivity														
a. Gross Alpha (pcl)														
Radium 226*														
b. Gross Beta														
Thorium 230**														
Uranium**														
3. Total Organic Carbon (TOC) (mg/l)														
If TOC> 10 mg/liter, then														
a. Nitrogen (Base Extraction)														
b. Organic Carbon, Dissolved														
c. Organic Carbon, Suspended														
d. Phenols														
e. Polycyclic Aromatics														
f. Sulfur (Acid Extraction)														
4. COD														
5. Coliform, Fecal														
6. Pesticides														

* Required if Gross Alpha> 4 picocuries per liter (pcl)
** Required if Gross Beta >1000 picocuries per liter (pcl)
N Non-Instantaneous Discharge

TABLE II A-4

SURFACE WATER QUALITY
BASELINE DATA

BASELINE DATA TO BE COLLECTED SEMI-MONTHLY

STATION: U.S.G.S. 09306030 Stewart Gulch Nr Rio Blanco, Co.
December 1974

	12/4													
1. Ammonia (mg/l) (Nitrogen)														
2. Arsenic (ug/l)														
3. Barium (ug/l)	60													
4. Bicarbonate (mg/l)														
5. Boron (ug/l)	35													
6. Cadmium (ug/l)	<20													
7. Calcium (mg/l)														
8. Carbonate (mg/l)														
9. Chloride (mg/l)														
10. Chromium (ug/l)	<6													
11. Color (PCU)														
12. Copper (ug/l)	2													
13. Cyanide (mg/l)														
14. Fluoride (mg/l)														
15. Iron (ug/l)	13													
16. Kjeldahl Nitrogen (mg/l)														
17. Lead (ug/l)	<6													
18. Lithium (ug/l)	5													
19. Magnesium (mg/l)														
20. Manganese (ug/l)	<4													
21. Mercury (ug/l)														
22. Nitrate (mg/l)														
23. Nitrite (mg/l)														
24. Odor														
25. Oil & Grease (mg/l)														
26. Ortho-Phosphorus (mg/l)														
27. Potassium (mg/l)														
28. Selenium (ug/l)														
29. Silica (mg/l)														
30. Sodium (mg/l)														
31. Solids, Dissolved (mg/l)														
32. Sulfate (mg/l)														
33. Sulfide (mg/l)														
34. Turbidity (JTU)														
35. Zinc (ug/l)	<20													

DATA TO BE OBTAINED QUARTERLY AT FOUR MAJOR STATIONS

1. Complete Element Scan														
2. Radioactivity														
a. Gross Alpha (pcl)														
Radium 226*														
b. Gross Beta														
Thorium 230**														
Uranium**														
3. Total Organic Carbon (TOC)														
If TOC> 10 mg/liter, then														
a. Nitrogen (Base Extraction)														
b. Organic Carbon, Dissolved														
c. Organic Carbon, Suspended														
d. Phenols														
e. Polycyclic Aromatics														
f. Sulfur (Acid Extraction)														
4. COD														
5. Coliform, Fecal														
6. Pesticides														

* Required if Gross Alpha> 4 picocuries per liter (pcl)
** Required if Gross Beta >1000 picocuries per liter (pcl)
N Non-Instantaneous Discharge

TABLE II A-5

SURFACE WATER QUALITY
BASELINE DATA

BASELINE DATA TO BE COLLECTED SEMI-MONTHLY

STATION: U.S.G.S. 09306050 Scandard Gulch Nr Rio Blanco, Co.
June 1974 and March 1975

	6/21		3/5											
1. Ammonia (mg/l) (Nitrogen)														
2. Arsenic (ug/l)	4		-											
3. Barium (ug/l)	0		-											
4. Bicarbonate (mg/l)	444		162											
5. Boron (ug/l)	140		110											
6. Cadmium (ug/l)	2		-											
7. Calcium (mg/l)	91		23											
8. Carbonate (mg/l)	46		0											
9. Chloride (mg/l)	10		3.2											
10. Chromium (ug/l)														
11. Color	-		200											
12. Copper (ug/l)	4		-											
13. Cyanide	-		.00											
14. Fluoride (mg/l)	.3		2.4											
15. Iron (ug/l)	20		-											
16. Kjeldahl Nitrogen (mg/l)	-		15											
17. Lead (ug/l)	6		-											
18. Lithium (ug/l)	10		-											
19. Magnesium (mg/l)	79		4.4											
20. Manganese (ug/l)	20		-											
21. Mercury (ug/l)	.0		-											
22. Nitrate (mg/l) as NO_3	-		.84											
23. Nitrite (mg/l) as NO_2	-		.30											
24. Odor	-		0											
25. Oil & Grease (mg/l)	-		4											
26. Ortho-Phosphorus (mg/l) (total)	.01		.32											
27. Potassium (mg/l)	2.2		-											
28. Selenium (ug/l)	2		0											
29. Silica (mg/l)	13		8.4											
30. Sodium (mg/l)	140		42											
31. Solids, Dissolved (mg/l)	951		176											
32. Sulfate (mg/l)	350		10											
33. Sulfide (mg/l)														
34. Turbidity (JTU)	-		1100											
35. Zinc (ug/l)	20		-											
36. pH	8.4		-											

DATA TO BE OBTAINED QUARTERLY
AT FOUR MAJOR STATIONS

1. Complete Element Scan														
2. Radioactivity														
a. Gross Alpha (pcl)														
Radium 226*														
b. Gross Beta														
Thorium 230**														
Uranium**														
3. Total Organic Carbon (TOC)														
If TOC> 10 mg/liter, then														
a. Nitrogen (Base Extraction)														
b. Organic Carbon, Dissolved														
c. Organic Carbon, Suspended														
d. Phenols														
e. Polycyclic Aromatics														
f. Sulfur (Acid Extraction)														
4. COD														
5. Coliform, Fecal														
6. Pesticides														

* Required if Gross Alpha> 4 picocuries per liter (pcl)
** Required if Gross Beta >1000 picocuries per liter (pcl)
N Non-Instantaneous Discharge

TABLE II A-6

SURFACE WATER QUALITY
BASELINE DATA

BASELINE DATA TO BE COLLECTED SEMI-MONTHLY

STATION: U.S.G.S. 09306052 Scandard Gulch at Mouth, Nr Rio Blanco, Co.
March 1975

	3/5													
1. Ammonia (mg/1) (Nitrogen)														
2. Arsenic (ug/1)														
3. Barium (ug/1)														
4. Bicarbonate (mg/1)	206													
5. Boron (ug/1)	170													
6. Cadmium (ug/1)														
7. Calcium (mg/1)	23													
8. Carbonate (mg/1)	0													
9. Chloride (mg/1)	13													
10. Chromium (ug/1)														
11. Color (PCU)	200													
12. Copper (ug/1)														
13. Cyanide	.00													
14. Fluoride (mg/1)	3.5													
15. Iron (ug/1)														
16. Kjeldahl Nitrogen (mg/1)	23													
17. Lead (ug/1)														
18. Lithium (ug/1)														
19. Magnesium (mg/1)	5.0													
20. Manganese (ug/1)														
21. Mercury (ug/1)														
22. Nitrate (mg/1) as NO_3	.58													
23. Nitrite (mg/1) as NO_2	.23													
24. Odor	0													
25. Oil & Grease (mg/1)	5													
26. Ortho-Phosphorus (mg/1) (total)	.52													
27. Potassium (mg/1)														
28. Selenium (ug/1)														
29. Silica (mg/1)	8.3													
30. Sodium (mg/1)	55													
31. Solids, Dissolved (mg/1)	223													
32. Sulfate (mg/1)	11													
33. Sulfide (mg/1)														
34. Turbidity JTU	960													
35. Zinc (ug/1)														

DATA TO BE OBTAINED QUARTERLY AT FOUR MAJOR STATIONS

1. Complete Element Scan														
2. Radioactivity														
a. Gross Alpha (pcl)														
Radium 226*														
b. Gross Beta														
Thorium 230**														
Uranium**														
3. Total Organic Carbon (TOC)														
If TOC> 10 mg/liter, then														
a. Nitrogen (Base Extraction)														
b. Organic Carbon, Dissolved														
c. Organic Carbon, Suspended														
d. Phenols														
e. Polycyclic Aromatics														
f. Sulfur (Acid Extraction)														
4. COD														
5. Coliform, Fecal														
6. Pesticides														

* Required if Gross Alpha> 4 picocuries per liter (pcl)
** Required if Gross Beta >1000 picocuries per liter (pcl)
N Non-Instantaneous Discharge

TABLE II A-7

SURFACE WATER QUALITY
BASELINE DATA

BASELINE DATA TO BE COLLECTED SEMI-MONTHLY

STATION: U.S.G.S. 09306058 Willow Creek Nr Rio Blanco, Co.
February - April 1975

	2/3	2/9	3/6	3/20	4/3	4/15								
1. Ammonia (mg/l) (Nitrogen)	.08	.03	.08	.02	.01	.02								
2. Arsenic (ug/l)	4	0	0	2	1	3								
3. Barium (ug/l)	100	100	100	<100	100	<100								
4. Bicarbonate (mg/l)	531	536	537	496	509	484								
5. Boron (ug/l)	110	130	100	100	110	120								
6. Cadmium (ug/l)	1	1	0	0	0	0								
7. Calcium (mg/l)	100	96	94	97	98	98								
8. Carbonate (mg/l)	0	0	0	0	0	0								
9. Chloride (mg/l)	12	11	9.9	11	9.7	12								
10. Chromium (ug/l)	0	10	0	10	0	0								
11. Color (PCU)	0	5	20	5	3	3								
12. Copper (ug/l)	4	4	1	1	1	0								
13. Cyanide (mg/l)	.00	.00	.00	.00	.00	.01								
14. Fluoride (mg/l)	.3	.4	.4	.6	.4	.3								
15. Iron (ug/l)	10	20	50	10	20	10								
16. Kjeldahl Nitrogen (mg/l)	1.0	1.1	1.2	.73	.99	.51								
17. Lead (ug/l)	2	2	2	3	1	0								
18. Lithium (ug/l)	0	10	10	10	10	10								
19. Magnesium (mg/l)	74	74	75	79	72	74								
20. Manganese (ug/l)	30	20	50	30	10	0								
21. Mercury (ug/l)	.2	.0	.0	.0	.0	.0								
22. Nitrate (mg/l) as NO_3	1.9	1.6	1.7	1.7	1.4	.93								
23. Nitrite (mg/l) as NO_2	.00	.00	.03	.00	.00	.03								
24. Odor	0	0	0	0	0	0								
25. Oil & Grease (mg/l)	5	7	4	3	5	2								
26. Ortho-Phosphorus (mg/l) Total	.00	.07	.10	.04	.03	.04								
27. Potassium (mg/l)	2.3	1.8	3.8	3.0	3.3	1.8								
28. Selenium (ug/l)	1	0	1	1	0	1								
29. Silica (mg/l)	17	15	14	14	15	14								
30. Sodium (mg/l)	120	110	110	110	110	110								
31. Solids, Dissolved (mg/l)	940	915	894	901	901	860								
32. Sulfate (mg/l)	350	340	320	340	340	310								
33. Sulfide (mg.l)	.1	.1	.3	.1	.0	.2								
34. Turbidity (JTU)	30	200	100	55	40	33								
35. Zinc (ug/l)	30	50	30	10	30	30								
36. pH	7.5	7.9	8.2	8.2	8.2	8.3								

DATA TO BE OBTAINED QUARTERLY AT FOUR MAJOR STATIONS

1. Complete Element Scan														
2. Radioactivity														
a. Gross Alpha (pcl) as U Natural	-	-	26											
Radium 226*														
b. Gross Beta as CS-137 & Sr90	-	-	38											
Thorium 230**														
Uranium**														
3. Total Organic Carbon (TOC) (mg/l)	-	-	16											
If TOC> 10 mg/liter, then														
a. Nitrogen (Base Extraction)														
b. Organic Carbon, Dissolved														
c. Organic Carbon, Suspended														
d. Phenols														
e. Polycyclic Aromatics														
f. Sulfur (Acid Extraction)														
4. COD	-	-	38											
5. Coliform, Fecal	-	-	5											
6. Pesticides	-	-	-											

* Required if Gross Alpha> 4 picocuries per liter (pcl)
** Required if Gross Beta >1000 picocuries per liter (pcl)
N Non-Instantaneous Discharge

TABLE II A-8

SURFACE WATER QUALITY
BASELINE DATA

BASELINE DATA TO BE
COLLECTED SEMI-MONTHLY

STATION: U.S.G.S. 09306061 Piceance Creek Ab Hunter Creek Nr Rio Blanco, Co.
February - April 1975

	2/3	2/19	3/6	3/20	4/3									
1. Ammonia (mg/1) (Nitrogen)	.04	.03	.09	.03	.04									
2. Arsenic (ug/1)	5	1	1	0	0									
3. Barium (ug/1)	<100	<100	100	<100	<100									
4. Bicarbonate (mg/1)	591	571	554	475	576									
5. Boron (ug/1)	150	160	170	160	150									
6. Cadmium (ug/1)	1	1	0	0	0									
7. Calcium (mg/1)	88	84	81	82	83									
8. Carbonate (mg/1)	0	0	0	39	0									
9. Chloride (mg/1)	13	14	13	14	14									
10. Chromium (ug/1)	10	0	0	0	0									
11. Color (PCU) (PCU)	-	5	30	8	3									
12. Copper (ug/1)	5	10	2	2	1									
13. Cyanide (mg/1)	.00	.03	.00	.00	.00									
14. Fluoride (mg/1)	.6	.7	.7	.9	.7									
15. Iron (ug/1)	30	20	60	30	.10									
16. Kjeldahl Nitrogen (mg/1)	.46	1.9	.99	.61	.79									
17. Lead (ug/1)	2	1	2	3	0									
18. Lithium (ug/1)	10	20	20	20	10									
19. Magnesium (mg/1)	67	70	64	70	64									
20. Manganese (ug/1)	40	30	30	30	0									
21. Mercury (ug/1)	.1	.0	.0	.0	.0									
22. Nitrate (mg/1) as NO_3	3.0	3.5	2.7	2.9	2.6									
23. Nitrite (mg/1) as NO_2	.03	.00	.03	.03	.00									
24. Odor	0	0	0	0	0									
25. Oil & Grease (mg/1)	8	4	4	3	2									
26. Ortho-Phosphorus (mg/1) (total)	--	.06	.10	.04	.04									
27. Potassium (mg/1)	2.7	2.6	4.8	3.9	5.0									
28. Selenium (ug/1)	1	1	1	1	1									
29. Silica (mg/1)	17	16	15	13	15									
30. Sodium (mg/1)	140	140	130	130	140									
31. Solids, Dissolved (mg/1)	944	923	835	851	889									
32. Sulfate (mg/1)	320	310	250	260	280									
33. Sulfide (mg/1)	.2	.0	.2	.1	.1									
34. Turbidity (JTU)	10	300	50	50	50									
35. Zinc (ug/1)	30	40	10	20	20									
36. pH	7.5	8.0	8.1	8.7	7.8									

DATA TO BE OBTAINED QUARTERLY
AT FOUR MAJOR STATIONS

1. Complete Element Scan														
2. Radioactivity														
a. Gross Alpha (pcl) as U Natural	-	-	8.1	-	-									
Radium 226*														
b. Gross Beta as Cs-137 & Sr90	-	-	126	-	-									
Thorium 230**														
Uranium**														
3. Total Organic Carbon (TOC)	-	-	8.2	-	-									
If TOC> 10 mg/liter, then														
a. Nitrogen (Base Extraction)														
b. Organic Carbon, Dissolved														
c. Organic Carbon, Suspended														
d. Phenols														
e. Polycyclic Aromatics														
f. Sulfur (Acid Extraction)														
4. COD	-	-	24	-	-									
5. Coliform, Fecal	-	-	12	-	-									
6. Pesticides	-	-	-	-	-									

* Required if Gross Alpha> 4 picocuries per liter (pcl)
** Required if Gross Beta >1000 picocuries per liter (pcl)
N Non-Instantaneous Discharge

TABLE II A-9
MINIMUM-MAXIMUM AND MEDIAN CONCENTRATIONS FOR SELECTED WATER QUALITY CONSTITUENTS

U.S.G.S. NO. 09306007
PICEANCE CREEK BELOW RIO BLANCO, CO.
April 23, 1974 to April 2, 1975
Elevation - 6366 ft. above MSL

Total No. of Samples		Minimum	Median	Maximum
34	Temperature (°C)	0.0	10.0	22.0
31	Discharge (CFS)	2.9	9.5	34
9	Turbidity (JTU) Dec. 1974-April 1975	6	20	130
33	Specific Conductivity (micromhos)	912	1160	1270
30	Dissolved Oxygen (mg/1)	7.0	10.2	13.0
33	pH	6.9	8.2	9.0
33	Alkalinity (mg/1)	358	445	506
33	Bicarbonate (mg/1)	436	542	617
23	Carbonate (mg/1)	0	0	32
9	Nitrate (NO_3) (mg/1) Dec. 1974-April 1975	0.44	1.4	2.5
34	Orthophosphate (mg/1)	0.00	0.06	1.1
34	Calcium (mg/1)	51	70	77
34	Magnesium (mg/1)	38	47	57
34	Sodium (mg/1)	88	130	160
34	Potassium (mg/1)	2.4	3.4	19
34	Chloride (mg/1)	9.7	16	24
34	Sulfate (mg/1)	130	170	200
34	Fluoride (mg/1)	0.2	1.0	1.3
34	Silica (mg/1)	3.4	16	18
34	Iron (ug/1)	10	50	390
33	Manganese (ug/1)	10	110	230
33	Dissolved Solids (mg/1)	578	718	829

TABLE II A-10
MINIMUM-MAXIMUM AND MEDIAN CONCENTRATIONS FOR SELECTED WATER QUALITY CONSTITUENTS

U.S.G.S. NO. 09306022
STEWART GULCH ab WEST FORK nr RIO BLANCO, CO.
September 12, 1974 to April 2, 1975

Total No. of Samples		Minimum	Median	Maximum
19	Temperature (^{o}C)	1.0	8.0	12.0
17	Discharge (CFS)	1.3	2.1	2.7
9	Turbidity (JTU) Dec. 1974-April 1975	3	10	30
19	Specific Conductivity (micromhos)	750	1370	1750
19	Dissolved Oxygen (mg/l)	7.9	10.2	14.0
19	pH	7.2	8.2	8.8
19	Alkalinity (mg/l)	387	421	641
19	Bicarbonate (mg/l)	437	511	782
9	Carbonate (mg/l)	0	0	38
9	Nitrate (NO_3) (mg/l) Dec. 1974-April 1975	7.5	7.9	8.4
19	Orthophosphate (mg/l)	0.00	0.03	0.15
19	Calcium (mg/l)	73	95	99
19	Magnesium (mg/l)	64	76	86
19	Sodium (mg/l)	120	120	250
19	Potassium (mg/l)	1.1	1.9	2.5
19	Chloride (mg/l)	6.0	7.0	16
19	Sulfate (mg/l)	330	370	380
19	Fluoride (mg/l)	0.1	0.3	3.3
19	Silica (mg/l)	14	15	17
19	Iron (ug/l)	10	20	620
19	Manganese (ug/l)	0	10	40
19	Dissolved Solids (mg/l)	865	950	1160

TABLE II A-11
MINIMUM-MAXIMUM AND MEDIAN CONCENTRATIONS FOR SELECTED WATER QUALITY CONSTITUENTS

U.S.G.S. NO. 09306025
WEST FORK STEWART GULCH NEAR RIO BLANCO, CO.
May 3, 1974 to November 20, 1974
Elevation - 6668 ft. above MSL

Total No. of Samples		Minimum	Median	Maximum
21	Temperature (^{O}C)	0.0	12.0	30.0
17	Discharge (CFS)	0.02	0.03	0.15
--	Turbidity (JTU) Dec. 1974-April 1975	-NR-	-NR-	-NR-
21	Specific Conductivity (micromhos)	1460	1620	2070
20	Dissolved Oxygen (mg/1)	6.6	8.8	13.5
20	pH	7.4	8.2	8.8
21	Alkalinity (mg/1)	374	437	621
21	Bicarbonate (mg/1)	438	533	757
12	Carbonate (mg/1)	0	0	13
	Nitrate (NO_3) (mg/1) Dec. 1974-April 1975	-NR-	-NR-	-NR-
21	Orthophosphate (mg/1)	0.00	0.06	0.12
21	Calcium (mg/1)	48	95	130
21	Magnesium (mg/1)	84	100	120
21	Sodium (mg/1)	130	160	220
21	Potassium (mg/1)	1.2	2.8	9.8
21	Chloride (mg/1)	7.6	10	29
21	Sulfate (mg/1)	380	480	590
21	Fluoride (mg/1)	0.0	0.2	1.2
21	Silica (mg/1)	8.9	15	18
21	Iron (ug/1)	20	40	210
21	Manganese (ug/1)	0	0	20
21	Dissolved Solids (mg/1)	943	1130	1450

NR - Not Recorded (not a major station)

TABLE II A-12
MINIMUM-MAXIMUM AND MEDIAN CONCENTRATIONS FOR SELECTED WATER QUALITY CONSTITUENTS

U.S.G.S. NO. 09306058
WILLOW CREEK nr RIO BLANCO, CO.
April 23, 1974 to April 3, 1975
Elevation - 6273 ft. above MSL

Total No. of Samples		Minimum	Median	Maximum
30	Temperature (°C)	0.0	11.0	18.5
25	Discharge (CFS)	0.56	1.1	4.1
9	Turbidity (JTU) Dec. 1974-April 1975	9	40	200
29	Specific Conductivity (micromhos)	1200	1390	1590
29	Dissolved Oxygen (mg/1)	7.7	10.0	12.6
29	pH	7.5	8.0	8.7
30	Alkalinity (mg/1)	395	425	476
30	Bicarbonate (mg/1)	482	515	580
22	Carbonate (mg/1)	0	0	9
9	Nitrate (NO_3) (mg/1) Dec. 1974-April 1975	1.4	1.8	2.7
30	Orthophosphate (mg/1)	0.00	0.03	0.15
30	Calcium (mg/1)	64	97	100
30	Magnesium (mg/1)	70	76	87
30	Sodium (mg/1)	110	130	180
30	Potassium (mg/1)	1.1	2.3	5.0
30	Chloride (mg/1)	9.3	11	14
30	Sulfate (mg/1)	320	350	500
30	Fluoride (mg/1)	0.2	0.4	1.3
30	Silica (mg/1)	8.2	16	18
30	Iron (ug/1)	0	30	320
30	Manganese (ug/1)	0	20	70
30	Dissolved Solids (mg/1)	875	934	1150

TABLE II A-13
MINIMUM-MAXIMUM AND MEDIAN CONCENTRATIONS FOR SELECTED WATER QUALITY CONSTITUENTS

U.S.G.S. No. 09306061
PICEANCE CREEK Ab HUNTER CREEK, Nr RIO BLANCO, CO.
April 23, 1974 to April 3, 1975
Elevation - 6214 ft. above MSL

Total No. of Samples		Minimum	Median	Maximum
29	Temperature (^{o}C)	0.0	14.0	23.0
22	Discharge (CFS)	4.6	6.3	31
6	Turbidity (JTU) Dec. 1974-April 1975	10	50	300
29	Specific Conductivity (micromhos)	1140	1400	1660
27	Dissolved Oxygen (mg/l)	6.8	9.6	16.0
29	pH	7.5	8.2	8.7
29	Alkalinity (mg/l)	363	493	566
29	Bicarbonate (mg/l)	443	601	690
18	Carbonate (mg/l)	0	0	39
6	Nitrate (NO_3) (mg/l) Dec. 1974-April 1975	2.6	2.9	3.5
29	Orthophosphate (mg/l)	0.00	0.09	0.25
29	Calcium (mg/l)	59	79	88
29	Magnesium (mg/l)	47	69	88
29	Sodium (mg/l)	120	160	200
29	Potassium (mg/l)	1.2	3.9	6.4
29	Chloride (mg/l)	11	14	16
29	Sulfate (mg/l)	220	300	380
29	Fluoride (mg/l)	0.3	0.7	1.5
29	Silica (mg/l)	12	17	20
29	Iron (ug/l)	10	30	880
29	Manganese (ug/l)	0	60	190
29	Dissolved Solids (mg/l)	736	944	1090

TABLE II A-14
COMPARISON OF RESULTS FROM TOSCO & USGS LABORATORIES GROUND WATER QUALITY

Component, mg/l	Piceance Creek Below Rio Blanco (No. 09306007, 1-15-75)		Piceance Creek AB Hunter C (No. 09306061, 1-16-75)	
	USGS	TOSCO	USGS	TOSCO
Sodium	130	124	140	141
Potassium	3.4	3.4	2.6	2.6
Calcium	74	65	79	72
Magnesium	46	51	64	75
Sulfate	160	167	290	294
Carbonate	0	9	0	5
Bicarbonate	552	523	545	545
Chloride	16	14	12	13
Fluoride	1.2	1.2	0.7	0.7
Borate	0.9	0.8	0.8	0.8
Cations, meq/l	13.22	12.93	15.37	15.97
Anions, meq/l	12.92	12.83	15.35	15.65
% Difference	1.1	0.4	0.1	1.0
Silica, mg/l	17	17	17	17
pH	8.1	8.4	8.1	8.4
Calculated TDS, mg/l	719	709	873	888

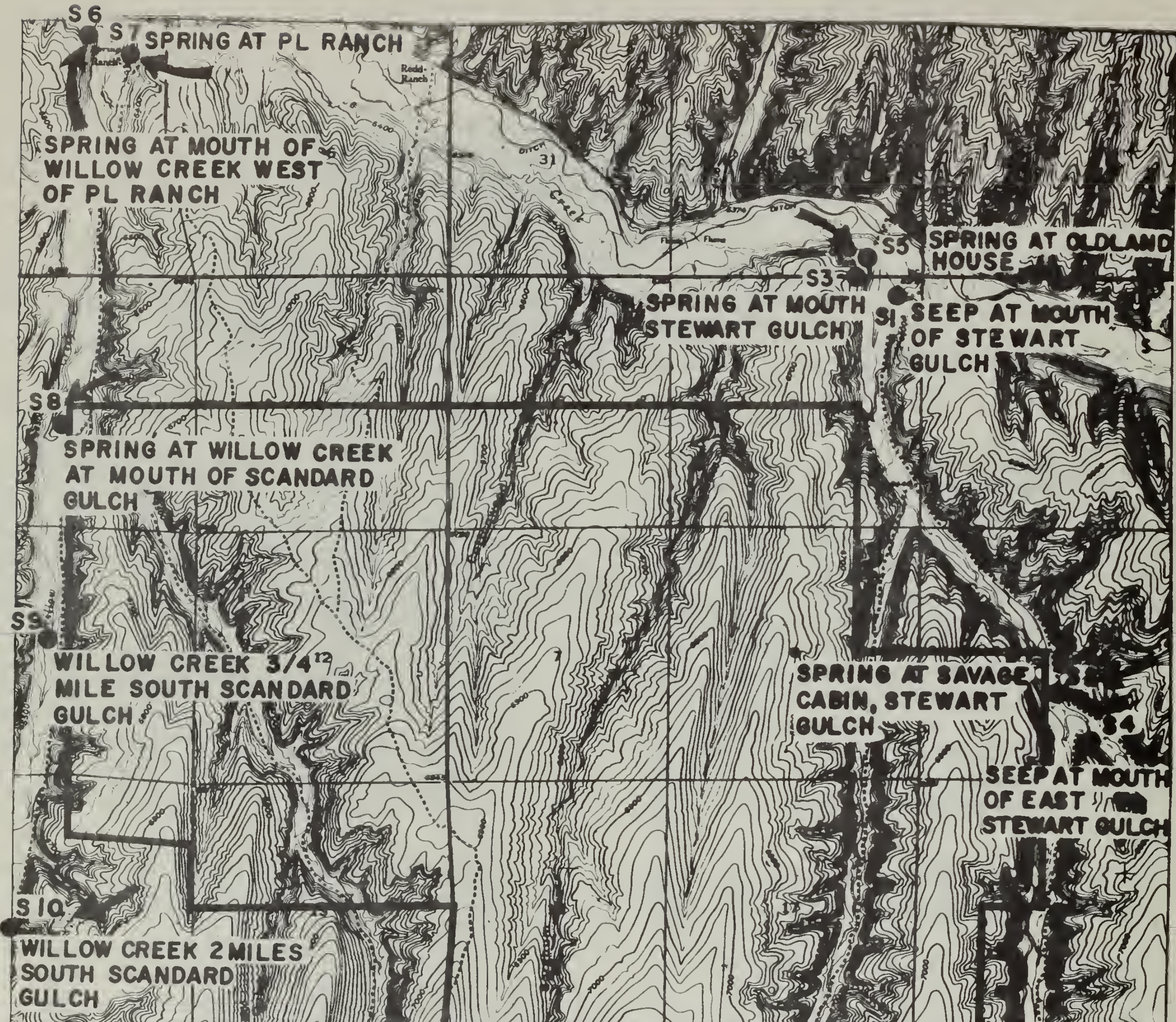

S6
S7 SPRING AT PL RANCH
Redd Ranch
SPRING AT MOUTH OF WILLOW CREEK WEST OF PL RANCH
S5 SPRING AT OLDLAND HOUSE
S3
SPRING AT MOUTH STEWART GULCH
S1 SEEP AT MOUTH OF STEWART GULCH
S8
SPRING AT WILLOW CREEK AT MOUTH OF SCANDARD GULCH
S9
WILLOW CREEK 3/4 MILE SOUTH SCANDARD GULCH
SPRING AT SAVAGE CABIN, STEWART GULCH
S2
S4
SEEP AT MOUTH OF EAST STEWART GULCH
S10
WILLOW CREEK 2 MILES SOUTH SCANDARD GULCH
31
19
21
24
26
30
R 97 W
R 96 W
SPRINGS & SEEPS
TRACT C-b
S SPRINGS OR SEEPS
SPRINGS REPORTED 3rd QUARTER
TRACT BOUNDARY
1/2
0
1 MILE

FIGURE II A-2

TABLE II A-15
WATER ANALYSIS
SPRINGS & SEEPS

	LOCATION AT WHICH SAMPLE TAKEN				
ELEMENT MEASURED--UNITS(mg/1) UNLESS NOTED	a	b			
1. Aluminum		6.1			
2. Ammonia (Nitrogen)		.1			
3. Arsenic		<.01			
4. Barium		<1.0			
5. Beryllium					
6. Bicarbonate	650	540			
7. Bismuth					
8. Boron		.6			
9. Cadmium		<.01			
10. Calcium	48	161			
11. Carbonate	<.1	<.1			
12. Cerium					
13. Chloride	17	.8			
14. Chrome, Hexavalent		<.01			
15. Cobalt					
16. Conductivity, Specific (μ℧/cc)					
17. Copper		<.1			
18. Fluoride	.2	1.4			
19. Gallium					
20. Hardness (mg/1 $CaCO_3$)	440	516			
21. Hydroxide		<.1			
22. Iron	<.05	<.47			
23. Lead		<.05			
24. Lithium		<.5			
25. Magnesium	78	28			
26. Manganese		<.05			
27. Mercury		<.01			
28. Molybdenum					
29. Nickel					
30. Nitrate	.5	.1			
31. pH	7.4				
32. Phosphate, Total	<.1	<.1			
33. Potassium					
34. Selenium		<.01			
35. Silica	21	13			
36. Sodium	240	125			
37. Solids, Dissolved	1090	910			
38. Strontium					
39. Sulfate	370	310			
40. Titanium					
41. Vanadium					
42. Yttrium					
43. Zinc		<.5			
44. Zirconium					
45. Radioactivity					
Gross Alpha (pcl)					
Radium 226*					
Gross Beta (pcl)					
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC) If TOC >10 mg/1 then measure					
Dissolved Organic Carbon					
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

a Spring floor of Piceance Creek Valley North of SG-19.
b Willow Creek 2 miles past Scandard Gulch.

TABLE II A-16

Tract C-b Radiocarbon Age-Dating Selected Springs

Spring	Age in Years B.P.
Oldland House Spring	3560 ± 230
Savage Cabin Spring	5680 ± 165
Spring at P. L. Ranch	2960 ± 195
Spring at Scandard Gulch	2800 ± 215

II B CORE DRILLING AND ASSOCIATED GROUND WATER

The information presented in this section of the summary report summarizes raw data which have been presented in Quarterly Report #3. In those cases where interpretations of the data have been made, the interpretations are included in this summary. Well Summary Table II B-1 has been updated from the table that appeared in Summary Report #2. Listed in the table are the various types of information which have been presented and the Quarterly Report in which they can be found.

II B-1 Well Survey Plats

Well survey plats for well SG-1a and slant holes NQ7 and NQ12 are presented in Quarterly Report #3. These three wells are shown by double circles in Figure II B-1, Well Locations, Tract C-b.

II B-2 Completion Data

The well completion report for SG-1 was updated and finalized in Quarterly Report #3.

II B-3 Drilling Water Production

No new drilling water production data are include in Quarterly Report #3. Drilling water production data for well AT-1 in tabular form were inadvertently left out of Quarterly Report #2, although the graphic presentation for this well was included therein. These data are included in tabular form in Quarterly Report #3, Pages II B-15 through II B-17.

Two preliminary drilling water production cross-sections were presented in Summary Report #2, Figures II B-9 and II B-10, Pages 23 and 24. No additional data nor interpretations are included herein.

II B-4 Water Quality - Drilling

One drilling water analysis, received too late for inclusion in Quarterly Report #2, is included in Quarterly Report #3. It represents a jetting test at 2405 feet in well SG-17. Data relating to the analysis can be found on Pages II B-19 through II B-22 in Quarterly Report #3.

TABLE II B-1
WELL SUMMARY TABLE

1. Well Designation	AT-1	AT-1a	AT-1a1	AT-1b	AT-1c	AT-1d	SG-1	SG1a	SG-6	SG-8	SG-9	SG-10	SG-10a	SG-11
2. Well Type	AT	AT (CH)	AT	AT	AT	AT	CH	GHT	CH (AT)	CH	CH	CH (AT)	GHT	CH (AT)
3. Completion Date	1/23/75	7/1/74	7/10/74	7/20/74	8/18/74	7/28/74	12/6/74	2/7/75	8/22/74	11/27/74	10/23/74	6/29/74	7/10/74	9/8/74
4. Total Depth (Geolograph) (feet)	1700	1621	1341	1638	1640	1640	2525	1180	2220	2608	2750	2211	1333	2826
5. Water Data														
a. Drilling Water Production	C1Q 2Q	C1Q	C1Q	C1Q	C1Q	C1Q	C2Q	C2Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q
b. Drilling Water Samples (# taken)	1	4	NA	NA	4	NA	7	NA	5	7	5	4	NA	25
c. Water Quality Analyses	C1Q 2Q	C1Q			C1Q		C2Q		C1Q	C2Q	C1Q	C1Q		C1Q
6. Aquifer Data														
a. Drill Stem Tests		C1Q			C1Q		C2Q C3Q			C3Q		C1Q		
b. Jetting Tests	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C2Q	C3Q	C1Q		C1Q	C1Q	C1Q	C1Q
7. Geophysical Logs,														
a. Schlumberger (1) Borehole, Compensated Sonic	C1Q	*		C1Q	C3Q	C1Q	C2Q		C3Q	C2Q	C2Q	*		C1Q
(2) Laterolog	C1Q	*		C1Q	C3Q	C1Q	C2Q		C3Q	C2Q	C2Q	*		C1Q
(3) Formation Density	C1Q	*		C1Q		C1Q	C2Q	C2Q		C2Q	C2Q	*		
(4) Compensated Neutron Formation Density		*		C1Q	C3Q	C1Q			C3Q			*		
(5) Temperature	C1Q	C1Q		C1Q	C3Q	C1Q	C2Q		C3Q	C2Q	C2Q	C1Q		C1Q
(6) Cement Bond Log		*		C3Q	C3Q	C3Q	C3Q		C3Q		C3Q	*		C3Q
(7) Perforated Depth Control							C3Q				C3Q			
(8) Casing Collar Log and Perforating Record														
(9) Oriented Perforating Record and Casing Collar Log				C3Q	C3Q	C3Q	C3Q		C3Q		C3Q			C3Q
b. Geophysical Logs, Other														
(1) Welex, Micro-seismogram		C1Q										C1Q		
(2) McCullough, Temperature				C1Q										
8. Field Lithologic Log	C1Q	C3Q	C1Q	C1Q	C1Q	C1Q	C3Q	C2Q	C3Q	C3Q	C3Q	C3Q	C1Q	C3Q
9. Cored Interval (feet from surface)														
a. Top	NA	1270	NA	NA	NA	NA	550	NA	1195	580	1200	1200	NA	750
b. Bottom	NA	1519	NA	NA	NA	NA	2525	NA	2220	2608	2750	2211	NA	2810
10. Assay Data														
a. Fischer Assay	NA	C1Q	NA	NA	NA	NA	C3Q	NA	C3Q	C3Q	C2Q	C1Q	NA	C3Q
b. Soluble Sodium	NA	C1Q	NA	NA	NA	NA	C3Q	NA	C3Q	C3Q	C2Q	C1Q	NA	C3Q
c. Alumina	NA	C1Q	NA	NA	NA	NA	C3Q	NA	C3Q	C3Q	C2Q	C1Q	NA	C3Q
11. Trace Element Analysis			C2Q 3Q							C2Q 3Q	C2Q 3Q	C2Q 3Q		
12. Rock Mechanics Data		C1Q										C1Q		
13. Gas Data														
a. Drilling Log	NA	NA	NA	NA		NA	C1Q		C1Q	C1Q	C1Q		NA	C1Q
b. Bomb Samples (# taken)	NA	NA	NA	NA	2	NA	8		4	11	8		NA	6
c. Bomb Analyses	C3Q	NA	NA	NA	C2Q	NA	C1Q 2Q		C1Q	C1Q 2Q	C1Q			C3Q C1Q
14. Completion Data	C2Q	C1Q	C1Q	C1Q	C1Q	C1Q	C3Q	C2Q	C1Q	C2Q	C1Q	C1Q	C1Q	C1Q
15. Survey Plat	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C3Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q

KEY: NA = Not Applicable
Inc. = Incomplete
C1Q = Complete, First Quarterly Report
C2Q = Complete, Second Quarterly Report
C3Q = Complete, Third Quarterly Report

AT = Aquifer Test
CH = Core Hole
GHT = Groundwater Test Hole

*Birdwell Company logs run on this well instead of Schlumberger. See Quarterly Report #1.

**Alluvial Pump Test.

# Not applicable. Wells drilled prior to granting C-b Tract Lease.

TABLE II B-1 (continued)
WELL SUMMARY TABLE

1. Well Designation	SG-17	SG-18	SG-18a	SG-19	SG-20	SG-21	Cb-1	Cb-2	Cb-2b	Cb-3	Cb-4	NQ7	NQ12
2. Well Type	CH	AB (GHT)	GHT	CH GHT	GHT	GHT	GHT	GHT	AB (GHT)	GHT	GHT	CH	CH
3. Completion Date	1/13/75	10/13/74	10/18/74	9/28/74	12/13/74	1/8/75	#	#	9/20/74	#	#		
4. Total Depth (Geolograph)	2460	1430	1330	980	987	1036	2104	1482	1220	2122	1470		
5. Water Data							#	#		#	#		
a. Drilling Water Production	C2Q	C1Q	C1Q	C1Q	C2Q	C2Q			C1Q				
b. Drilling Water Samples	31	3	1	4	5	5							
c. Water Quality Analyses	C2Q 3Q	C1Q	C1Q	C1Q	C2Q	C2Q							
6. Aquifer Data							#	#		#	#		
a. Drill Stem Tests	C2Q 3Q				C2Q 3Q	C2Q 3Q							
b. Jetting Tests	C2Q 3Q	C1Q	C1Q	C1Q	C2Q	C2Q							
7. Geophysical Logs,													
a. Schlumberger (1) Borehole, Compensated Sonic	C2Q	C1Q		C1Q	C2Q	C2Q							
(2) Laterolog	C2Q	C1Q		C1Q		C2Q							
(3) Formation Density	C2Q	C1Q		C1Q	C2Q	C2Q							
(4) Compensated Neutron Formation Density													
(5) Temperature	C2Q	C1Q		C1Q	C2Q	C2Q	C2Q	C2Q		C2Q	C2Q		
(6) Cement Bond Log	C3Q						C3Q	C3Q			C3Q		
(7) Perforated Depth Control	C3Q						C3Q	C3Q					
(8) Casing Collar Log and Perforating Record							C3Q	C3Q			C3Q		
(9) Oriented Perforating Record and Casing Collar Log	C3Q												
b. Geophysical Logs, Other													
(1) Welex, Micro-seismogram													
(2) McCullough, Temperature													
8. Field Lithologic Log	C3Q	C3Q	C1Q	C3Q	C2Q	C2Q	#	#	C1Q	#	#		
9. Cored Interval							#	#		#	#		
a. Top	800	1380	NA	930					NA				
b. Bottom	2460	1426	NA	980									
10. Assay Data							#	#	NA	#	#		
a. Fischer Assay	C3Q	C3Q		C1Q	C3Q	C3Q							
b. Soluble Sodium	C3Q	C3Q		C3Q	C3Q	C3Q							
c. Alumina	C3Q	C3Q		C3Q	C3Q	C3Q							
11. Trace Element Analysis							#	#	NA	#	#		
12. Rock Mechanics Data							#	#	NA	#	#		
13. Gas Data							#	#		#	#		
a. Drilling Log	C2Q	C1Q	C1Q	C1Q	C2Q				C1Q				
b. Bomb Samples	31	1	1	4	5	4			1				
c. Bomb Analyses	C1Q-C3Q	C1Q	C1Q	C1Q	C2Q	C2Q			C1Q				
14. Completion Data	C2Q	C1Q	C1Q	C1Q	C2Q	C2Q	C1Q	C2Q	C1Q	C1Q	C1Q		
15. Survey Plat	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C3Q	C3Q

KEY: NA = Not Applicable
Inc. = Incomplete
C1Q = Complete, First Quarterly Report
C2Q = Complete, Second Quarterly Report
C3Q = Complete, Third Quarterly Report

AT = Aquifer Test
CH = Core Hole
GHT = Groundwater Test Hole

*Birdwell Company logs run on this well instead of Schlumberger. See Quarterly Report #1.

**Alluvial Pump Test.

# Not applicable. Wells drilled prior to granting C-b Tract Lease.

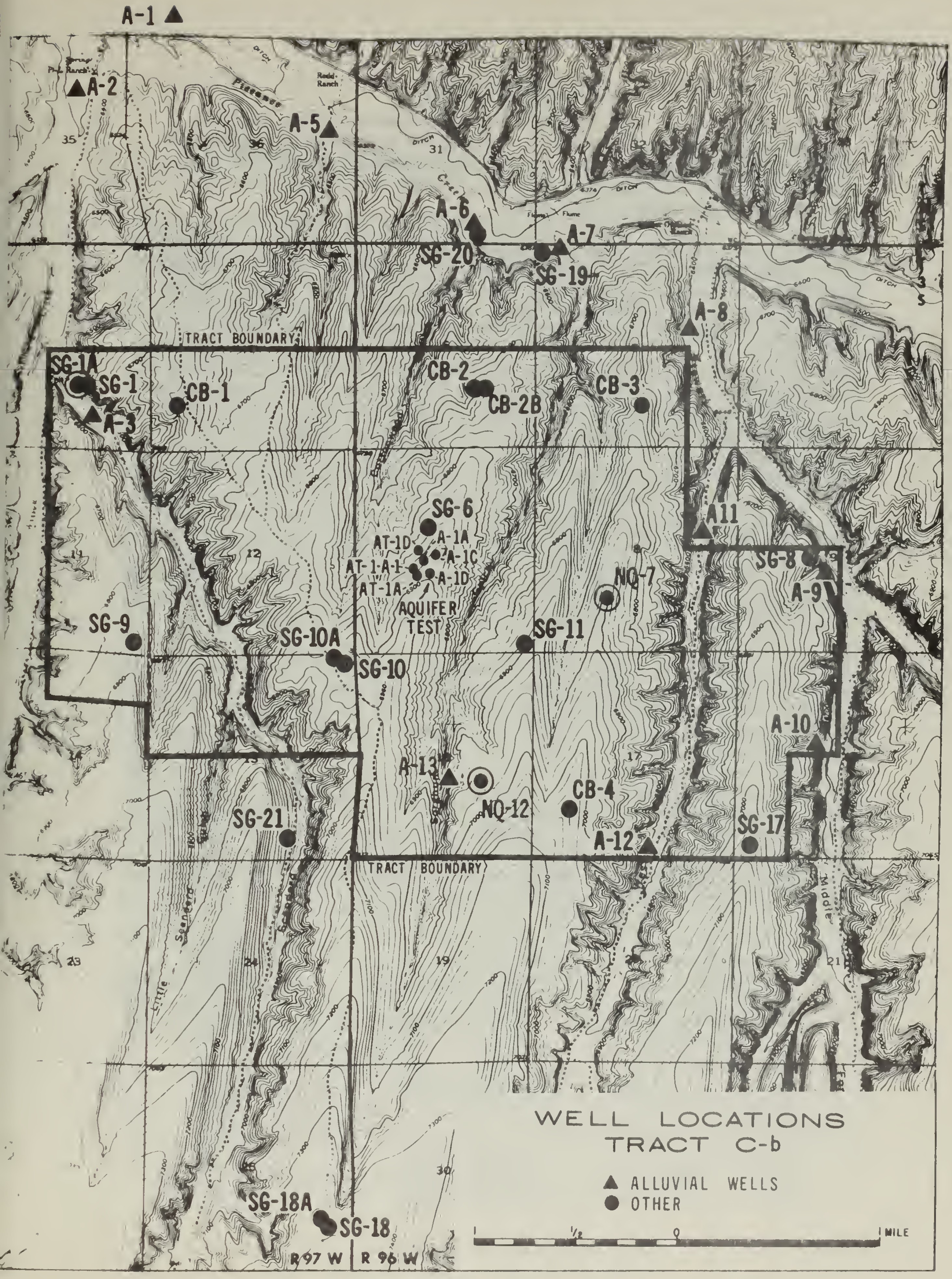
TABLE II B-1 (continued)
WELL SUMMARY TABLE

1. Well Designation	A-1	A-2	A-3	A-4	A-5	A-6	A-7	A-8	A-9	A-10	A-11	A-12	A-13
2. Well Type	AW	AW	AW	AW	AW	AW	AW	AW	AW	AW	AW	AW	AW
3. Completion Date (1974)	10/2	10/4	10/7	10/8	10/3	10/10	9/28	10/1	9/23	9/23	9/24	9/24	10/8
4. Total Depth (Geolograph)	112	82	109	64	86	60	51	70	57	67	66	81	14
5. Water Data													
a. Drilling Water Production													
b. Drilling Water Samples													
c. Water Quality Analyses	C1Q	C1Q	C1Q	NA	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	NA
6. Aquifer Data													
a. Drill Stem Tests													
b. Jetting Tests													
7. Geophysical Logs,	NO LOGS RUN												
a. Schlumberger (1) Borehole, Compensated Sonic													
(2) Laterolog													
(3) Formation Density													
(4) Compensated Neutron Formation Density													
(5) Temperature													
(6) Cement Bond Log													
(7) Perforated Depth Control													
(8) Casing Collar Log and Perforating Record													
(9) Oriented Perforating Record and Casing Collar Log													
b. Geophysical Logs, Other													
(1) Welex, Micro-seismogram													
(2) McCullough, Temperature													
8. Field Lithologic Log	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C2Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q
9. Cored Interval	WELLS NOT CORED												
a. Top													
b. Bottom													
10. Assay Data	NO ASSAYS												
a. Fischer Assay													
b. Soluble Sodium													
c. Alumina													
11. Trace Element Analysis	NO ANALYSIS												
12. Rock Mechanics Data	NO ROCK MECHANICS DATA												
13. Gas Data	NO GAS DATA												
a. Drilling Log													
b. Bomb Samples													
c. Bomb Analyses													
14. Completion Data	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q
15. Survey Plat	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q	C1Q

KEY: NA = Not Applicable
Inc. = Incomplete
C1Q = Complete, First Quarterly Report
C2Q = Complete, Second Quarterly Report
C3Q = Complete, Third Quarterly Report

AW = Alluvial Well

*Birdwell Company logs run on this well instead of Schlumberger. See Quarterly Report #1.
**Alluvial Pump Test.
# Not applicable. Wells drilled prior to granting C-b Tract Lease.



WELL LOCATIONS
TRACT C-b

FIGURE II B-1

II B-5 Water Quality - Baseline

The presentation of analysis of the environmental water samples (groundwater baseline) started in Quarterly Report #2 is continued in Quarterly Report #3. In the following summary tables the semi-annual analysis is presented for all aquifer monitoring wells and the pre-leasing, wells coded C-b.

Inasmuch as the Water Quality Summary Tables are placed in this volume as a convenience to the casual reader, it should be pointed out that some elements may occur in such small quantities that their presence may go undetected. This is to say, the amount of a given element is less than the detection limits of the analytical method used.

For example, as is stated in the surface water section of this report, the quantity of a given element may be reported as "less than" or perhaps zero. In either case, it generally means that if there is any amount of the given element present or the water sample, it is below the detectable limit of the analytical method used. There are exceptions to this and anyone using the summary tables for any purpose other than general information should be aware of this. For example, if the amount of carbonate is reported as zero, this does not mean that the amount present is below detectable limits. It means that there is in fact no carbonate in the sample. This occurs because below a pH of 8.2 theoretically all carbonate is chemically changed to bicarbonate. Those interested in analysis are referred to the actual laboratory data which is reported in the Quarterly Report.

The second baseline water quality sampling run did not include alluvial wells A-3 and A-6. A sample was not collected from alluvial well A-3 because the small pump used to collect samples malfunctioned. Also, during this time the stream flow in Piceance Creek made alluvial well A-6 inaccessible.

It required approximately three weeks to obtain the water samples from observation strings in 16 wells. While each well was being swabbed to obtain a sample for analysis, water conductivity was monitored. Precautions were taken at each site to assure that water produced in sampling did not enter a stream course. The following are representative of the conductivities observed and sampled:

Well Name and String No.	Range of Conductivity μυ/cc	Stabilized Conductivity μυ/cc
SG-1, String #1	9,500- 2,200	4,225
SG-8, String #1	2,000- 1,400	1,800
SG-9, String #1	20,000- 1,800	6,500
SG-10	55,000-47,000	50,000
SG-11, String #3	1,830- 1,800	1,800
SG-20		2,800
SG-21	1,000- 920	920
AT-1C, String #2	1,300- 1,175	1,175
Cb-1	4,000- 2,450	3,800
Cb-4	1,000- 850	850

(Text Continued on Page 54)

TABLE II B-2
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: AT-1c, String #1

Depth: 1550'-1640'

Location: SW¼ Sec. 7 T3S R96W

Elevation: 6905 G.L.

	DATE ON WHICH SAMPLE TAKEN					
ELEMENT MEASURED--UNITS(mg/1) UNLESS NOTED	11-17-74	4-17-74				
1. Aluminum	.9	.08				
2. Ammonia (Nitrogen)	.12	1.0				
3. Arsenic	.03	.003				
4. Barium	.04	.3				
5. Beryllium	<.001	<.001				
6. Bicarbonate	180	780				
7. Bismuth	<.003	.002				
8. Boron	1.1	.43				
9. Cadmium	.003	<.001				
10. Calcium	3.7	4				
11. Carbonate	160	30				
12. Cerium	<.003	<.001				
13. Chloride	36	4				
14. Chrome, Hexavalent	.003	<.01				
15. Cobalt	.006	.004				
16. Conductivity, Specific (μ℧/cc)	1420	1150				
17. Copper	.1	.03				
18. Fluoride	10	19				
19. Gallium	.002	<.001				
20. Hardness (mg/1 $CaCO_3$)	26	80				
21. Hydroxide	<.1	<.1				
22. Iron	.2	<.05				
23. Lead	.02	.01				
24. Lithium	<.5	<.5				
25. Magnesium	4.1	4				
26. Manganese	.06	.04				
27. Mercury	.0019	<.001				
28. Molybdenum	.07	.03				
29. Nickel	.02	<.001				
30. Nitrate	<.1	<.1				
31. pH	9.0	9.0				
32. Phosphate, Total	.1	<.1				
33. Potassium	-	7				
34. Selenium	<.003	.002				
35. Silica	12	10				
36. Sodium	520	310				
37. Solids, Dissolved	1224	800				
38. Strontium	.4	1				
39. Sulfate	96	17				
40. Titanium	.08	.08				
41. Vanadium	.003	≤.001				
42. Yttrium	<.003	≤.001				
43. Zinc	.2	.7				
44. Zirconium	.004	.001				
45. Radioactivity						
Gross Alpha (pcl)	4	4				
Radium 226*		.7				
Gross Beta (pcl)	41	11				
Thorium 230**						
Uranium **						
46. Total Organic Carbon (TOC)	< 1	< 4				
If TOC >10 mg/1 then measure						
Dissolved Organic Carbon		<5				
Suspended Organic Carbon						
Phenols						
Sulfate, Acid Extraction						
Nitrogen, Base Extraction						
Polycyclic Aromatics						

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-3
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: AT-1c, String #2
Location: SW¼ Sec. 7 T3S R96W

Depth: 1430'-1500'
Elevation: 6905' G.L.

DATE ON WHICH SAMPLE TAKEN

ELEMENT MEASURED--UNITS(mg/1) UNLESS NOTED	11-7-74	4-17-75			
1. Aluminum	.5	.4			
2. Ammonia (Nitrogen)	.17	.4			
3. Arsenic	.05	.01			
4. Barium	.1	.2			
5. Beryllium	.002	<.001			
6. Bicarbonate	465	738			
7. Bismuth	<.008	≤.001			
8. Boron	1.4	.64			
9. Cadmium	<.008	<.001			
10. Calcium	37	7			
11. Carbonate	<.1	18			
12. Cerium	<.008	<.001			
13. Chloride	3	3			
14. Chrome, Hexavalent	.005	<.01			
15. Cobalt	.003	.001			
16. Conductivity, Specific (μ℧/cc)	1350	1150			
17. Copper	.03	.02			
18. Fluoride	8.8	16			
19. Gallium	<.008	≤.001			
20. Hardness (mg/1 $CaCO_3$)	200	32			
21. Hydroxide	<.1	<.1			
22. Iron	.18	<.05			
23. Lead	.03	.02			
24. Lithium	<.5	<.5			
25. Magnesium	27	8			
26. Manganese	.2	.3			
27. Mercury	.0009	<.001			
28. Molybdenum	.1	.08			
29. Nickel	.006	.001			
30. Nitrate	<.1	<.1			
31. pH	7.9	8.8			
32. Phosphate, Total	<.1	<.1			
33. Potassium	6.4	3			
34. Selenium	<.008	.003			
35. Silica	15	19			
36. Sodium	220	313			
37. Solids, Dissolved	810	765			
38. Strontium	5	1			
39. Sulfate	230	14			
40. Titanium	.1	.03			
41. Vanadium	.002	.001			
42. Yttrium	<.008	<.001			
43. Zinc	.05	.05			
44. Zirconium	<.008	.01			
45. Radioactivity					
Gross Alpha (pcl)	1.6	7.2			
Radium 226*		.1			
Gross Beta (pcl)	0	0			
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC)					
If TOC >10 mg/1 then measure	<1	2			
Dissolved Organic Carbon		2			
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-4
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: AT-1c, String #3
Location: SW¼ Sec. 7 T3S R96W
Depth: 60'-1340'
Elevation: 6905' G.L.

	DATE ON WHICH SAMPLE TAKEN				
ELEMENT MEASURED--UNITS(mg/1) UNLESS NOTED	11-7-74	4-17-75			
1. Aluminum	.9	.08			
2. Ammonia (Nitrogen)	.23	1.1			
3. Arsenic	.06	.02			
4. Barium	.02	.06			
5. Beryllium	<.002	<.001			
6. Bicarbonate	452	464			
7. Bismuth	<.002	<.001			
8. Boron	1.3	.16			
9. Cadmium	<.002	<.001			
10. Calcium	15	44			
11. Carbonate	9	9			
12. Cerium	<.002	<.001			
13. Chloride	7	6			
14. Chrome, Hexavalent	.006	<.01			
15. Cobalt	.002	<.001			
16. Conductivity, Specific (μ℧/cc)	1200	1250			
17. Copper	.03	.02			
18. Fluoride	6.4	4			
19. Gallium	<.002	<.001			
20. Hardness (mg/1 $CaCO_3$)	150	300			
21. Hydroxide	<.1	<.1			
22. Iron	.28	<.05			
23. Lead	.01	.01			
24. Lithium	.5	<.5			
25. Magnesium	23	45			
26. Manganese	.2	.04			
27. Mercury	.008	<.001			
28. Molybdenum	.02	.03			
29. Nickel	.01	<.001			
30. Nitrate	<.1	.5			
31. pH	8.6	8.5			
32. Phosphate, Total	<.1	<.1			
33. Potassium	3.6	4			
34. Selenium	<.002	<.004			
35. Silica	18	13			
36. Sodium	221	227			
37. Solids, Dissolved	750	883			
38. Strontium	2	3			
39. Sulfate	226	303			
40. Titanium	.08	.05			
41. Vanadium	<.001	<.001			
42. Yttrium	<.002	<.001			
43. Zinc	.03	.07			
44. Zirconium	<.002	<.001			
45. Radioactivity					
Gross Alpha (pcl)	2	7.7			
Radium 226*		0			
Gross Beta (pcl)	2	0			
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC)	<1	1			
If TOC >10 mg/1 then measure Dissolved Organic Carbon		1			
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-5
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: Cb - 1
Location: SW¼ Sec. 1 T3S R97W

Depth: 1540' - 2079'
Elevation: 6760' G.L.

	DATE ON WHICH SAMPLE TAKEN				
ELEMENT MEASURED--UNITS(mg/l) UNLESS NOTED	11-18-74	4-12-75			
1. Aluminum	.05	.08			
2. Ammonia (Nitrogen)	2.1	3.4			
3. Arsenic	.002	.008			
4. Barium	.08	.3			
5. Beryllium	<.002	<.003			
6. Bicarbonate	2570	2706			
7. Bismuth	<.002	<.003			
8. Boron	.7	.9			
9. Cadmium	<.002	<.003			
10. Calcium	9.4	9			
11. Carbonate	<.1	43			
12. Cerium	<.002	<.003			
13. Chloride	82	27			
14. Chrome, Hexavalent	.006	<.01			
15. Cobalt	.01	.01			
16. Conductivity, Specific (μ℧/cc)	3800	3900			
17. Copper	.09	.03			
18. Fluoride	16	28			
19. Gallium	<.002	.003			
20. Hardness (mg/l $CaCO_3$)	35	52			
21. Hydroxide	<.1	<.1			
22. Iron	.3	<.05			
23. Lead	<.008	.02			
24. Lithium	.3	<1.0			
25. Magnesium	8.2	7.2			
26. Manganese	.2	.002			
27. Mercury	-	.00009			
28. Molybdenum	.02	.07			
29. Nickel	.009	.06			
30. Nitrate	.5	.9			
31. pH	8.2	8.2			
32. Phosphate, Total	<.1	<.1			
33. Potassium	9	14			
34. Selenium	<.002	.004			
35. Silica	11	15			
36. Sodium	980	990			
37. Solids, Dissolved	2366	2350			
38. Strontium	.4	.6			
39. Sulfate	<4	12			
40. Titanium	.05	.2			
41. Vanadium	.002	.004			
42. Yttrium	<.002	<.003			
43. Zinc	.04	.004			
44. Zirconium	<.002	.004			
45. Radioactivity					
Gross Alpha (pcl)	4.3	18			
Radium 226*	0.1	.1			
Gross Beta (pcl)	0	0			
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC) If TOC >10 mg/l then measure Dissolved Organic Carbon	<1	6			
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-6
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: Cb - 2
Location: SE¼ Sec. 6 T3S R96W

Depth: 34'- 1320'
Elevation: 6737' G.L.

	DATE ON WHICH SAMPLE TAKEN				
ELEMENT MEASURED--UNITS(mg/l) UNLESS NOTED	11-16-74	4-14-75			
1. Aluminum	.15	--			
2. Ammonia (Nitrogen)	.5	.5			
3. Arsenic	.02	.02			
4. Barium	.04	.1			
5. Beryllium	<.001	<.001			
6. Bicarbonate	450	550			
7. Bismuth	.005	<.001			
8. Boron	2.9	<.1			
9. Cadmium	<.002	.004			
10. Calcium	8.2	4.1			
11. Carbonate	3.6	46			
12. Cerium	<.002	<.001			
13. Chloride	9.6	11			
14. Chrome, Hexavalent	0.3	<.01			
15. Cobalt	.002	.008			
16. Conductivity, Specific (μ℧/cc)	1600	1600			
17. Copper	3	.05			
18. Fluoride	2.9	4.0			
19. Gallium	.003	<.001			
20. Hardness (mg/l $CaCO_3$)	39	24			
21. Hydroxide	<.1	<.1			
22. Iron	.5	1.2			
23. Lead	.02	.07			
24. Lithium	<.5	<1.0			
25. Magnesium	4.5	3.3			
26. Manganese	.1	.1			
27. Mercury	-	<.001			
28. Molybdenum	.04	.04			
29. Nickel	.02	.2			
30. Nitrate	.3	1.2			
31. pH	8.4	8.7			
32. Phosphate, Total	<.1	<.1			
33. Potassium	3.0	6			
34. Selenium	<.002	.002			
35. Silica	17	19			
36. Sodium	350	350			
37. Solids, Dissolved	976	1013			
38. Strontium	.7	.8			
39. Sulfate	360	370			
40. Titanium	.07	.03			
41. Vanadium	.002	.003			
42. Yttrium	<.002	<.001			
43. Zinc	.4	.1			
44. Zirconium	<.002	.002			
45. Radioactivity					
Gross Alpha (pcl)	1.8	12			
Radium 226*		0.0			
Gross Beta (pcl)	0	0			
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC) If TOC >10 mg/l then measure	<1	4			
Dissolved Organic Carbon					
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-7
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: Cb-4
Location: SW¼ Sec. 17 T3S R96W

Depth: open
Elevation: 7054' G.L.

	DATE ON WHICH SAMPLE TAKEN				
ELEMENT MEASURED--UNITS(mg/1) UNLESS NOTED	11-17-74	4-13-75			
1. Aluminum		.3			
2. Ammonia (Nitrogen)	.4	.4			
3. Arsenic	.01	.02			
4. Barium	.02	.2			
5. Beryllium	<.001	<.002			
6. Bicarbonate	360	400			
7. Bismuth	<.002	<.002			
8. Boron	2.8	.4			
9. Cadmium	<.002	.008			
10. Calcium	30	23			
11. Carbonate	<.1	12			
12. Cerium	<.002	<.002			
13. Chloride	6.9	7			
14. Chrome, Hexavalent	.03	<.01			
15. Cobalt	<.002	.006			
16. Conductivity, Specific (μ℧/cc)	840	920			
17. Copper	.5	.09			
18. Fluoride	1.0	.9			
19. Gallium	.003	≤.002			
20. Hardness (mg/1 $CaCO_3$)	180	170			
21. Hydroxide	<.1	<.1			
22. Iron	.3	<.05			
23. Lead	<.01	.02			
24. Lithium	.3	<1.0			
25. Magnesium	28	25			
26. Manganese	.1	.02			
27. Mercury		<.002			
28. Molybdenum	.02	.04			
29. Nickel	.02	.08			
30. Nitrate	.2	.4			
31. pH	7.7	8.2			
32. Phosphate, Total	<.1	.1			
33. Potassium	.4	<1.0			
34. Selenium	<.002	<.002			
35. Silica	24	32			
36. Sodium	150	146			
37. Solids, Dissolved	574	554			
38. Strontium	2	3			
39. Sulfate	160	126			
40. Titanium	.08	.3			
41. Vanadium	.001	.001			
42. Yttrium	<.002	<.002			
43. Zinc	.07	1			
44. Zirconium	<.002	<.002			
45. Radioactivity					
Gross Alpha (pcl)	1.0	16			
Radium 226*		.1			
Gross Beta (pcl)	0	0			
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC) If TOC >10 mg/1 then measure Dissolved Organic Carbon	<1	3			
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-8
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: SG-1, String #1
Location: SE¼ Sec. 2 T3S R97W

Depth: 1071-1726
Elevation: 6428 G.L.

	DATE ON WHICH SAMPLE TAKEN				
ELEMENT MEASURED--UNITS(mg/l) UNLESS NOTED	4-29-75				
1. Aluminum	--				
2. Ammonia (Nitrogen)	4.4				
3. Arsenic	.005				
4. Barium	.09				
5. Beryllium	≤.001				
6. Bicarbonate	2650				
7. Bismuth	≤.001				
8. Boron	12				
9. Cadmium	≤.001				
10. Calcium	16				
11. Carbonate	36				
12. Cerium	≤.001				
13. Chloride	270				
14. Chrome, Hexavalent	<.01				
15. Cobalt	≤.001				
16. Conductivity, Specific (μ℧/cc)	4600				
17. Copper	.09				
18. Fluoride	21				
19. Gallium	.002				
20. Hardness (mg/l $CaCO_3$)	100				
21. Hydroxide	<.1				
22. Iron	<.05				
23. Lead	.02				
24. Lithium	1.0				
25. Magnesium	15				
26. Manganese	.1				
27. Mercury	<.001				
28. Molybdenum	.1				
29. Nickel	.02				
30. Nitrate	<.1				
31. pH	8.2				
32. Phosphate, Total	<.1				
33. Potassium	29				
34. Selenium	--				
35. Silica	18				
36. Sodium	1250				
37. Solids, Dissolved	3080				
38. Strontium	.9				
39. Sulfate	125				
40. Titanium	.006				
41. Vanadium	≤.001				
42. Yttrium	≤.001				
43. Zinc	.1				
44. Zirconium	.08				
45. Radioactivity					
Gross Alpha (pcl)	23				
Radium 226*	0				
Gross Beta (pcl)	0				
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC)	6				
If TOC >10 mg/l then measure					
Dissolved Organic Carbon	4				
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-9
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: SG-1, String #2
Location: SE¼ Sec. 2 T3S R97W

Depth: 151-990
Elevation: 6428 G.L.

	DATE ON WHICH SAMPLE TAKEN				
ELEMENT MEASURED--UNITS(mg/1) UNLESS NOTED	4-30-75				
1. Aluminum	.9				
2. Ammonia (Nitrogen)	.5				
3. Arsenic	.03				
4. Barium	.04				
5. Beryllium	≤.002				
6. Bicarbonate	605				
7. Bismuth	<.002				
8. Boron	.42				
9. Cadmium	<.002				
10. Calcium	43				
11. Carbonate	12				
12. Cerium	<.002				
13. Chloride	20				
14. Chrome, Hexavalent	<.01				
15. Cobalt	≤.002				
16. Conductivity, Specific (μ℧/cc)	1320				
17. Copper	.05				
18. Fluoride	3.0				
19. Gallium	<.002				
20. Hardness (mg/1 $CaCO_3$)	270				
21. Hydroxide	<.1				
22. Iron	<.05				
23. Lead	.02				
24. Lithium	<1.0				
25. Magnesium	39				
26. Manganese	.03				
27. Mercury	<.001				
28. Molybdenum	.02				
29. Nickel	.02				
30. Nitrate	<.1				
31. pH	8.1				
32. Phosphate, Total	<.1				
33. Potassium	2.1				
34. Selenium	.004				
35. Silica	30				
36. Sodium	245				
37. Solids, Dissolved	905				
38. Strontium	2				
39. Sulfate	215				
40. Titanium	.03				
41. Vanadium	.003				
42. Yttrium	<.002				
43. Zinc	.1				
44. Zirconium	≤.002				
45. Radioactivity					
Gross Alpha (pcl)	8.1				
Radium 226*	0				
Gross Beta (pcl)	0				
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC)	<1				
If TOC >10 mg/1 then measure Dissolved Organic Carbon	<1				
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-10
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: SG-6, String #1
Location: SE¼ Sec. 7 T3S R96W

Depth: 1625-2208
Elevation: 6888 G.L.

	DATE ON WHICH SAMPLE TAKEN				
ELEMENT MEASURED--UNITS(mg/l) UNLESS NOTED	4-18-75				
1. Aluminum	5				
2. Ammonia (Nitrogen)	6.3				
3. Arsenic	.003				
4. Barium	.06				
5. Beryllium	≤.001				
6. Bicarbonate	755				
7. Bismuth	≤.001				
8. Boron	.65				
9. Cadmium	≤.001				
10. Calcium	19				
11. Carbonate	6				
12. Cerium	≤.001				
13. Chloride	220				
14. Chrome, Hexavalent	<.01				
15. Cobalt	≤.001				
16. Conductivity, Specific (μ℧/cc)	2090				
17. Copper	.03				
18. Fluoride	11				
19. Gallium	.001				
20. Hardness (mg/l $CaCO_3$)	88				
21. Hydroxide	<.1				
22. Iron	<.05				
23. Lead	.01				
24. Lithium	<1.0				
25. Magnesium	9.8				
26. Manganese	0.2				
27. Mercury	<.001				
28. Molybdenum	.01				
29. Nickel	.02				
30. Nitrate	1.6				
31. pH	8.2				
32. Phosphate, Total	<.1				
33. Potassium	40				
34. Selenium	≤.001				
35. Silica	5.3				
36. Sodium	460				
37. Solids, Dissolved	1310				
38. Strontium	.7				
39. Sulfate	170				
40. Titanium	.05				
41. Vanadium	.002				
42. Yttrium	.01				
43. Zinc	.03				
44. Zirconium	.002				
45. Radioactivity					
Gross Alpha (pcl)	3.5				
Radium 226*					
Gross Beta (pcl)	12				
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC)	6				
If TOC >10 mg/l then measure					
Dissolved Organic Carbon	7				
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-11
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: SG-6, String #2
Location: SE¼ Sec. 7 T3S R96W

Depth: 1430-1470
Elevation: 6888 G.L.

	DATE ON WHICH SAMPLE TAKEN				
ELEMENT MEASURED--UNITS(mg/1) UNLESS NOTED	4-18-75				
1. Aluminum	2				
2. Ammonia (Nitrogen)	1.8				
3. Arsenic	.009				
4. Barium	.06				
5. Beryllium	≤.001				
6. Bicarbonate	525				
7. Bismuth	≤.001				
8. Boron	.70				
9. Cadmium	≤.001				
10. Calcium	12				
11. Carbonate	30				
12. Cerium	≤.001				
13. Chloride	64				
14. Chrome, Hexavalent	<.01				
15. Cobalt	≤.001				
16. Conductivity, Specific (μ℧/cc)	1305				
17. Copper	.01				
18. Fluoride	12				
19. Gallium	≤.001				
20. Hardness (mg/1 $CaCO_3$)	100				
21. Hydroxide	<.1				
22. Iron	<.05				
23. Lead	.01				
24. Lithium	<1.0				
25. Magnesium	17				
26. Manganese	.02				
27. Mercury	<.001				
28. Molybdenum	.1				
29. Nickel	.006				
30. Nitrate	< .1				
31. pH	8.5				
32. Phosphate, Total	< .1				
33. Potassium	20				
34. Selenium	≤.001				
35. Silica	3.3				
36. Sodium	245				
37. Solids, Dissolved	755				
38. Strontium	.7				
39. Sulfate	93				
40. Titanium	.05				
41. Vanadium	≤.001				
42. Yttrium	≤.001				
43. Zinc	--				
44. Zirconium	≤.001				
45. Radioactivity					
Gross Alpha (pcl)	6				
Radium 226*	.4				
Gross Beta (pcl)	0				
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC) If TOC >10 mg/1 then measure Dissolved Organic Carbon	7				
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-12
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: SG-6, String 3
Location: SE¼, Sec. 7 T3S R96W

Depth: 60-1193
Elevation: 6888' G.L.

	DATE ON WHICH SAMPLE TAKEN				
ELEMENT MEASURED--UNITS(mg/1) UNLESS NOTED	4-18-75				
1. Aluminum	.5				
2. Ammonia (Nitrogen)	1.8				
3. Arsenic	.009				
4. Barium	.06				
5. Beryllium	≤.001				
6. Bicarbonate	455				
7. Bismuth	≤.001				
8. Boron	.35				
9. Cadmium	≤.001				
10. Calcium	93				
11. Carbonate	12				
12. Cerium	≤.001				
13. Chloride	34				
14. Chrome, Hexavalent	<.01				
15. Cobalt	≤.001				
16. Conductivity, Specific (µ℧/cc)	1580				
17. Copper	.03				
18. Fluoride	.3				
19. Gallium	≤.001				
20. Hardness (mg/1 $CaCO_3$)	560				
21. Hydroxide	<.1				
22. Iron	.44				
23. Lead	.007				
24. Lithium	<1.0				
25. Magnesium	80				
26. Manganese	.2				
27. Mercury	<.001				
28. Molybdenum	.003				
29. Nickel	.02				
30. Nitrate	0.5				
31. pH	8.3				
32. Phosphate, Total	<.1				
33. Potassium	<1.0				
34. Selenium	≤.004				
35. Silica	23				
36. Sodium	200				
37. Solids, Dissolved	1170				
38. Strontium	17				
39. Sulfate	510				
40. Titanium	.05				
41. Vanadium	.002				
42. Yttrium	≤.001				
43. Zinc	.7				
44. Zirconium	≤.001				
45. Radioactivity					
Gross Alpha (pcl)	.4				
Radium 226*					
Gross Beta (pcl)	0				
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC) If TOC >10 mg/1 then measure Dissolved Organic Carbon	9				
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-13
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: SG-8, String #1
Location: S½ Sec. 9 T3S R96W

Depth: 952-2608
Elevation: 6538 G.L.

	DATE ON WHICH SAMPLE TAKEN				
ELEMENT MEASURED--UNITS(mg/l) UNLESS NOTED	4-23-75				
1. Aluminum	.01				
2. Ammonia (Nitrogen)	1.8				
3. Arsenic	.02				
4. Barium	.4				
5. Beryllium	≤.001				
6. Bicarbonate	1200				
7. Bismuth	≤.001				
8. Boron	1.1				
9. Cadmium	≤.001				
10. Calcium	5.3				
11. Carbonate	33				
12. Cerium	≤.001				
13. Chloride	2.8				
14. Chrome, Hexavalent	<.01				
15. Cobalt	≤.001				
16. Conductivity, Specific (μ℧/cc)	1800				
17. Copper	.02				
18. Fluoride	26				
19. Gallium	.002				
20. Hardness (mg/l $CaCO_3$)	48				
21. Hydroxide	<.01				
22. Iron	<.05				
23. Lead	.009				
24. Lithium	<1.0				
25. Magnesium	8.5				
26. Manganese	.05				
27. Mercury	<.001				
28. Molybdenum	.008				
29. Nickel	.006				
30. Nitrate	0.2				
31. pH	8.4				
32. Phosphate, Total	<.1				
33. Potassium	1.0				
34. Selenium	.003				
35. Silica	14				
36. Sodium	490				
37. Solids, Dissolved	1180				
38. Strontium	.8				
39. Sulfate	12				
40. Titanium	.01				
41. Vanadium	.001				
42. Yttrium	≤.001				
43. Zinc	.5				
44. Zirconium	.002				
45. Radioactivity					
Gross Alpha (pcl)	2.8				
Radium 226*					
Gross Beta (pcl)	0				
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC) If TOC >10 mg/l then measure Dissolved Organic Carbon	5				
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-14
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: SG-8, String #2
Location:

Depth: 169-952
Elevation:

DATE ON WHICH SAMPLE TAKEN

ELEMENT MEASURED--UNITS(mg/l) UNLESS NOTED	4-23-75				
1. Aluminum	.04				
2. Ammonia (Nitrogen)	1.6				
3. Arsenic	.03				
4. Barium	.6				
5. Beryllium	<.001				
6. Bicarbonate	1210				
7. Bismuth	<.001				
8. Boron	1.9				
9. Cadmium	<.001				
10. Calcium	24				
11. Carbonate	36				
12. Cerium	<.001				
13. Chloride	35				
14. Chrome, Hexavalent	<.01				
15. Cobalt	≤.001				
16. Conductivity, Specific (μ℧/cc)	2060				
17. Copper	.01				
18. Fluoride	15				
19. Gallium	.002				
20. Hardness (mg/l $CaCO_3$)	990				
21. Hydroxide	<.1				
22. Iron	<.05				
23. Lead	.01				
24. Lithium	<1.0				
25. Magnesium	29				
26. Manganese	.04				
27. Mercury	<.001				
28. Molybdenum	.01				
29. Nickel	.02				
30. Nitrate	.4				
31. pH	8.3				
32. Phosphate, Total	<.1				
33. Potassium	1.0				
34. Selenium	.02				
35. Silica	18				
36. Sodium	490				
37. Solids, Dissolved	1340				
38. Strontium	3				
39. Sulfate	105				
40. Titanium	.08				
41. Vanadium	≤.001				
42. Yttrium	≤.001				
43. Zinc	1				
44. Zirconium	.003				
45. Radioactivity					
Gross Alpha (pcl)	11				
Radium 226*	0				
Gross Beta (pcl)	0				
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC) If TOC >10 mg/l then measure Dissolved Organic Carbon	3				
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-15
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: SG-9, String #1 Depth: 1316-2324
Location: SE¼ Sec. 11 T3S, R97W Elevation: 6870' G.L.

	DATE ON WHICH SAMPLE TAKEN				
ELEMENT MEASURED--UNITS(mg/l) UNLESS NOTED	11-29-74	4-11-75			
1. Aluminum	.4	.05			
2. Ammonia (Nitrogen)	.1	6.8			
3. Arsenic	.02	.006			
4. Barium	.08	.08			
5. Beryllium	.001	<.002			
6. Bicarbonate	860	1640			
7. Bismuth	<.002	<.002			
8. Boron	4.9	4.3			
9. Cadmium	.1	<.002			
10. Calcium	19	9			
11. Carbonate	72	67			
12. Cerium	.002	<.002			
13. Chloride	44	84			
14. Chrome, Hexavalent	.006	<.01			
15. Cobalt	.002	.002			
16. Conductivity, Specific (μ℧/cc)	1500	3200			
17. Copper	.03	.009			
18. Fluoride	18	25			
19. Gallium	.003	.002			
20. Hardness (mg/l $CaCO_3$)	78.	36			
21. Hydroxide	<.1	<.1			
22. Iron	.68	<.05			
23. Lead	.01	.01			
24. Lithium	.22	1.3			
25. Magnesium	7.5	3.3			
26. Manganese	.09	.02			
27. Mercury	--	<.001			
28. Molybdenum	.07	.04			
29. Nickel	.003	.03			
30. Nitrate	<.1	<.1			
31. pH	8.6	8.3			
32. Phosphate, Total	<.1	<.1			
33. Potassium	5.3	16			
34. Selenium	.005	<.002			
35. Silica	15	14			
36. Sodium	400	790			
37. Solids, Dissolved	1050	1850			
38. Strontium	2	.2			
39. Sulfate	51	57			
40. Titanium	.1	.3			
41. Vanadium	.002	.004			
42. Yttrium	<.002	<.002			
43. Zinc	1	.05			
44. Zirconium	<.002	.005			
45. Radioactivity					
Gross Alpha (pcl)	4.5	6.4			
Radium 226*	0	0			
Gross Beta (pcl)	0	0			
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC) If TOC >10 mg/l then measure Dissolved Organic Carbon	<1	8			
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-16
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: SG-9, String #2
Location: SE¼ Sec. 11 T3S R97W

Depth: 1054-1210
Elevation: 6870' G.L.

	DATE ON WHICH SAMPLE TAKEN				
ELEMENT MEASURED--UNITS(mg/l) UNLESS NOTED	11-29-74	4-11-75			
1. Aluminum	.7	.05			
2. Ammonia (Nitrogen)	.2	.8			
3. Arsenic	.009	.01			
4. Barium	.07	.1			
5. Beryllium	.003	<.001			
6. Bicarbonate	690	685			
7. Bismuth	<.004	<.001			
8. Boron	1.5	0.4			
9. Cadmium	<.004	<.001			
10. Calcium	117	72			
11. Carbonate	42	<.1			
12. Cerium	<.004	<.001			
13. Chloride	60	19			
14. Chrome, Hexavalent	<.01	<.01			
15. Cobalt	.01	.003			
16. Conductivity, Specific (µ℧/cc)	1640	1840			
17. Copper	.03	.05			
18. Fluoride	.2	1.3			
19. Gallium	<.004	.001			
20. Hardness (mg/l $CaCO_3$)	570	640			
21. Hydroxide	<.1	<.1			
22. Iron	.18	<.05			
23. Lead	<.02	.02			
24. Lithium	.27	<1.0			
25. Magnesium	68	110			
26. Manganese	.4	.1			
27. Mercury	--	<.001			
28. Molybdenum	.08	.02			
29. Nickel	.02	.04			
30. Nitrate	.4	.4			
31. pH	8.8	8.0			
32. Phosphate, Total	<.1	.4			
33. Potassium	4.8	16			
34. Selenium	.009	.001			
35. Silica	22	32			
36. Sodium	310	230			
37. Solids, Dissolved	1332	1230			
38. Strontium	3	2			
39. Sulfate	375	430			
40. Titanium	.05	.03			
41. Vanadium	.004	≤.001			
42. Yttrium	<.004	<.001			
43. Zinc	.1	1			
44. Zirconium	<.004	.001			
45. Radioactivity					
Gross Alpha (pcl)	1.7	7.6			
Radium 226*		0			
Gross Beta (pcl)	15	0			
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC)	8	5			
If TOC >10 mg/l then measure					
Dissolved Organic Carbon					
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-17
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: SG-10, String #1
Location: NE¼ Sec. 13 T3S R97W

Depth: 1425-1500
Elevation: 6950' G.L.

	DATE ON WHICH SAMPLE TAKEN				
ELEMENT MEASURED--UNITS(mg/1) UNLESS NOTED	4-11-75				
1. Aluminum	.3				
2. Ammonia (Nitrogen)	197				
3. Arsenic	22				
4. Barium	5				
5. Beryllium	≤.001				
6. Bicarbonate	25,000				
7. Bismuth	.005				
8. Boron	405				
9. Cadmium	≤.004				
10. Calcium	4.9				
11. Carbonate	1620				
12. Cerium	≤.004				
13. Chloride	9750				
14. Chrome, Hexavalent	<.01				
15. Cobalt	<.004				
16. Conductivity, Specific (µ℧/cc)	45,000				
17. Copper	.09				
18. Fluoride	47				
19. Gallium	≤.03				
20. Hardness (mg/1 $CaCO_3$)	60				
21. Hydroxide	<.1				
22. Iron	3.1				
23. Lead	.04				
24. Lithium	79				
25. Magnesium	10				
26. Manganese	.1				
27. Mercury	<.0001				
28. Molybdenum	.08				
29. Nickel	---				
30. Nitrate	.47				
31. pH	8.3				
32. Phosphate, Total	.7				
33. Potassium	122				
34. Selenium	21				
35. Silica	21				
36. Sodium	16,750				
37. Solids, Dissolved	41,989				
38. Strontium	2				
39. Sulfate	25				
40. Titanium	.03				
41. Vanadium	.1				
42. Yttrium	≤.02				
43. Zinc	.03				
44. Zirconium	.4				
45. Radioactivity					
Gross Alpha (pcl)	320				
Radium 226*	16				
Gross Beta (pcl)	<.1				
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC) If TOC >10 mg/1 then measure	26				
Dissolved Organic Carbon	25				
Suspended Organic Carbon	17				
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).

** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-18
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: SG-10A
Location: NE¼ Sec. 13 T3S R97W

Depth: 60-1333
Elevation: 6950'

		DATE ON WHICH SAMPLE TAKEN			
ELEMENT MEASURED--UNITS(mg/l) UNLESS NOTED	4-11-75				
1. Aluminum	.06				
2. Ammonia (Nitrogen)	1.7				
3. Arsenic	.006				
4. Barium	.02				
5. Beryllium	≤.002				
6. Bicarbonate	310				
7. Bismuth	≤.002				
8. Boron	3.2				
9. Cadmium	≤.002				
10. Calcium	51				
11. Carbonate	12				
12. Cerium	≤.002				
13. Chloride	7.3				
14. Chrome, Hexavalent	<.01				
15. Cobalt	≤.002				
16. Conductivity, Specific (μ℧/cc)	1280				
17. Copper	.005				
18. Fluoride	.41				
19. Gallium	≤.002				
20. Hardness (mg/l $CaCO_3$)	370				
21. Hydroxide	<.1				
22. Iron	.08				
23. Lead	.01				
24. Lithium	<1.0				
25. Magnesium	60				
26. Manganese	.03				
27. Mercury	<.0001				
28. Molybdenum	.04				
29. Nickel	.01				
30. Nitrate	<.1				
31. pH	8.1				
32. Phosphate, Total	<.1				
33. Potassium	<1.0				
34. Selenium	.007				
35. Silica	27				
36. Sodium	200				
37. Solids, Dissolved	990				
38. Strontium	4				
39. Sulfate	480				
40. Titanium	.03				
41. Vanadium	≤.002				
42. Yttrium	≤.002				
43. Zinc	.3				
44. Zirconium	≤.002				
45. Radioactivity					
Gross Alpha (pcl)	6.1				
Radium 226*	0				
Gross Beta (pcl)	0				
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC) If TOC >10 mg/l then measure	<1				
Dissolved Organic Carbon					
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-19
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: SG-11, String No. 1,
Location: SE¼ Sec. 7 T3S R96W

Depth: 1580-2460
Elevation: 6900' G.L.

	DATE ON WHICH SAMPLE TAKEN				
ELEMENT MEASURED--UNITS(mg/1) UNLESS NOTED	11/2/74	4-12-75			
1. Aluminum	0.4	.04			
2. Ammonia (Nitrogen)	-	91			
3. Arsenic	.03	.2			
4. Barium	5	2			
5. Beryllium	.002	≤.004			
6. Bicarbonate	21,594	20,640			
7. Bismuth	<.006	≤.004			
8. Boron	315	305			
9. Cadmium	<.006	≤.004			
10. Calcium	6	16			
11. Carbonate	1962	1720			
12. Cerium	<.006	≤.004			
13. Chloride	8154	9820			
14. Chrome, Hexavalent	.007	<.01			
15. Cobalt	.03	≤.009			
16. Conductivity, Specific (μ℧/cc)	40,000	40,000			
17. Copper	0.2	.2			
18. Fluoride	48	46			
19. Gallium	.02	≤.03			
20. Hardness (mg/1 CaCO$_3$)	48	120			
21. Hydroxide	<.1	<.1			
22. Iron	2.3	<.05			
23. Lead	.03	.4			
24. Lithium	79	63			
25. Magnesium	14	10			
26. Manganese	.07	.04			
27. Mercury	.0026	.0002			
28. Molybdenum	.01	.1			
29. Nickel	--	--			
30. Nitrate	.1	.65			
31. pH	8.8	8.4			
32. Phosphate, Total	<.1	<.1			
33. Potassium	125	120			
34. Selenium	<.006	.01			
35. Silica	24	38			
36. Sodium	16,367	15,500			
37. Solids, Dissolved	38,592	37,142			
38. Strontium	3	1			
39. Sulfate	2	90			
40. Titanium	.2	.3			
41. Vanadium	.02	.1			
42. Yttrium	.03	≤.01			
43. Zinc	.03	.05			
44. Zirconium	.9	.6			
45. Radioactivity					
Gross Alpha (pcl)	43	460			
Radium 226*	27	4.3			
Gross Beta (pcl)	390	<.1			
Thorium 230**	0				
Uranium **	0				
46. Total Organic Carbon (TOC) If TOC >10 mg/1 then measure	29	25			
Dissolved Organic Carbon	11	26			
Suspended Organic Carbon	5	19			
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-20
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: SG-11, String 2
Location: SE¼ Sec. 7 T3S R96W

Depth: 1385-1435
Elevation: 6900' G.L.

	DATE ON WHICH SAMPLE TAKEN				
ELEMENT MEASURED--UNITS(mg/1) UNLESS NOTED	4-12-75				
1. Aluminum	.08				
2. Ammonia (Nitrogen)	.54				
3. Arsenic	.05				
4. Barium	.09				
5. Beryllium	≤.002				
6. Bicarbonate	738				
7. Bismuth	≤.002				
8. Boron	1.1				
9. Cadmium	≤.002				
10. Calcium	10				
11. Carbonate	21				
12. Cerium	≤.002				
13. Chloride	20				
14. Chrome, Hexavalent	<.01				
15. Cobalt	≤.001				
16. Conductivity, Specific (μ℧/cc)	1750				
17. Copper	.01				
18. Fluoride	14				
19. Gallium	≤.002				
20. Hardness (mg/1 CaCO$_3$)	88				
21. Hydroxide	.1				
22. Iron	< .05				
23. Lead	.04				
24. Lithium	<.5				
25. Magnesium	13				
26. Manganese	.05				
27. Mercury	<.0004				
28. Molybdenum	.2				
29. Nickel	.04				
30. Nitrate	<.1				
31. pH	8.5				
32. Phosphate, Total	<.1				
33. Potassium	5				
34. Selenium	.004				
35. Silica	10				
36. Sodium	327				
37. Solids, Dissolved	868				
38. Strontium	2				
39. Sulfate	82				
40. Titanium	.03				
41. Vanadium	.002				
42. Yttrium	.01				
43. Zinc	4				
44. Zirconium	≤.002				
45. Radioactivity					
Gross Alpha (pcl)	7.8				
Radium 226*	0				
Gross Beta (pcl)	0				
Thorium 230**	.				
Uranium **					
46. Total Organic Carbon (TOC)	2				
If TOC >10 mg/1 then measure Dissolved Organic Carbon	3				
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-21
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: SG-11, String 3
Location: SE¼ Sec. 7 T3S R96W
Depth: 60-1290
Elevation: 6900' G.L.

DATE ON WHICH SAMPLE TAKEN

ELEMENT MEASURED--UNITS(mg/l) UNLESS NOTED	4-12-75				
1. Aluminum	.04				
2. Ammonia (Nitrogen)	.68				
3. Arsenic	.2				
4. Barium	2				
5. Beryllium	≤.004				
6. Bicarbonate	730				
7. Bismuth	≤.004				
8. Boron	1.5				
9. Cadmium	≤.004				
10. Calcium	18				
11. Carbonate	48				
12. Cerium	≤.004				
13. Chloride	53				
14. Chrome, Hexavalent	<.01				
15. Cobalt	≤.009				
16. Conductivity, Specific (μ℧/cc)	1750				
17. Copper	.2				
18. Fluoride	4.4				
19. Gallium	≤.03				
20. Hardness (mg/l $CaCO_3$)	340				
21. Hydroxide	<.1				
22. Iron	<.05				
23. Lead	.4				
24. Lithium	<1.0				
25. Magnesium	72				
26. Manganese	.04				
27. Mercury	<.0002				
28. Molybdenum	.1				
29. Nickel	--				
30. Nitrate	<.1				
31. pH	8.7				
32. Phosphate, Total	<.1				
33. Potassium	12				
34. Selenium	.01				
35. Silica	2.9				
36. Sodium	310				
37. Solids, Dissolved	1130				
38. Strontium	1				
39. Sulfate	250				
40. Titanium	.3				
41. Vanadium	.1				
42. Yttrium	≤.01				
43. Zinc	.05				
44. Zirconium	.6				
45. Radioactivity					
Gross Alpha (pcl)	7.2				
Radium 226*	0				
Gross Beta (pcl)	0				
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC)	3				
If TOC >10 mg/l then measure					
Dissolved Organic Carbon	4				
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-22
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: SG-17, String #1 Depth: 1292-2254
Location: SW¼ Sec. 16 T3S R96W Elevation: 7036' G.L.

DATE ON WHICH SAMPLE TAKEN

ELEMENT MEASURED--UNITS(mg/l) UNLESS NOTED	4-12-75				
1. Aluminum	.2				
2. Ammonia (Nitrogen)	100				
3. Arsenic	.09				
4. Barium	8				
5. Beryllium	.001				
6. Bicarbonate	18,100				
7. Bismuth	≤.008				
8. Boron					
9. Cadmium	≤.008				
10. Calcium	11				
11. Carbonate	720				
12. Cerium	≤.008				
13. Chloride	6913				
14. Chrome, Hexavalent	.01				
15. Cobalt	≤.02				
16. Conductivity, Specific (μ℧/cc)	32,000				
17. Copper	.04				
18. Fluoride	34				
19. Gallium	≤.06				
20. Hardness (mg/l $CaCO_3$)	130				
21. Hydroxide	<.1				
22. Iron	1.5				
23. Lead	.07				
24. Lithium	43				
25. Magnesium	13				
26. Manganese	.09				
27. Mercury	<.0001				
28. Molybdenum	.04				
29. Nickel	---				
30. Nitrate	.47				
31. pH	8. 5				
32. Phosphate, Total	<.1				
33. Potassium	85				
34. Selenium	.02				
35. Silica	24				
36. Sodium	10,750				
37. Solids, Dissolved	28,307				
38. Strontium	6				
39. Sulfate	115				
40. Titanium	1				
41. Vanadium	.03				
42. Yttrium	≤.03				
43. Zinc	.05				
44. Zirconium	.3				
45. Radioactivity					
Gross Alpha (pcl)	3.1				
Radium 226*					
Gross Beta (pcl)	0				
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC)	18				
If TOC >10 mg/l then measure					
Dissolved Organic Carbon	20				
Suspended Organic Carbon	16				
-Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-23
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: SG 17, String #2
Location: SW¼ Sec. 16 T3S R.96W

Depth: 63' - 1228'
Elevation: 7036'G.L.

DATE ON WHICH SAMPLE TAKEN

ELEMENT MEASURED--UNITS(mg/1) UNLESS NOTED	4-12-75				
1. Aluminum	.07				
2. Ammonia (Nitrogen)	7.9				
3. Arsenic	.03				
4. Barium	.1				
5. Beryllium	≤.003				
6. Bicarbonate	2105				
7. Bismuth	≤.003				
8. Boron	18				
9. Cadmium	≤.003				
10. Calcium	7				
11. Carbonate	60				
12. Cerium	≤.003				
13. Chloride	514				
14. Chrome, Hexavalent	<.01				
15. Cobalt	≤.003				
16. Conductivity, Specific (μ℧/cc)	4200				
17. Copper	.01				
18. Fluoride	17				
19. Gallium	≤.003				
20. Hardness (mg/1 $CaCO_3$)	84				
21. Hydroxide	<.1				
22. Iron	<.05				
23. Lead	.02				
24. Lithium	3.1				
25. Magnesium	7				
26. Manganese	.01				
27. Mercury	.0031				
28. Molybdenum	.1				
29. Nickel	.01				
30. Nitrate	1.9				
31. pH	8.8				
32. Phosphate, Total	<.1				
33. Potassium	9				
34. Selenium	.007				
35. Silica	28				
36. Sodium	1233				
37. Solids, Dissolved	3079				
38. Strontium	.2				
39. Sulfate	99				
40. Titanium	.3				
41. Vanadium	.006				
42. Yttrium	≤.003				
43. Zinc	2				
44. Zirconium	.03				
45. Radioactivity					
Gross Alpha (pcl)	21				
Radium 226*	.2				
Gross Beta (pcl)	0				
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC)	4				
If TOC >10 mg/1 then measure					
Dissolved Organic Carbon	9				
Suspended Organic Carbon					
-Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-24
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: SG-18A
Location: SE¼ Sec. 25, T3S R97W

Depth: 1330
Elevation: 7383' G.L.

	DATE ON WHICH SAMPLE TAKEN				
ELEMENT MEASURED--UNITS(mg/l) UNLESS NOTED	11-1-74	5-3-75			
1. Aluminum	.5	.03			
2. Ammonia (Nitrogen)		.95			
3. Arsenic	.02	.006			
4. Barium	.03	.04			
5. Beryllium	<.007	<.002			
6. Bicarbonate	471	475			
7. Bismuth	<.007	<.002			
8. Boron	1.4	.70			
9. Cadmium	<.007	<.002			
10. Calcium	24	28			
11. Carbonate	0	12			
12. Cerium	<.007	<.002			
13. Chloride	3	12			
14. Chrome, Hexavalent	-	<.01			
15. Cobalt	.001	<.002			
16. Conductivity, Specific (μ℧/cc)		930			
17. Copper	.02	.01			
18. Fluoride	190	<.1			
19. Gallium	<.007	<.002			
20. Hardness (mg/l $CaCO_3$)	-	240			
21. Hydroxide	-	<.1			
22. Iron	.02	<.05			
23. Lead	<.02	.01			
24. Lithium	.3	<1.0			
25. Magnesium	30	42			
26. Manganese	.04	.03			
27. Mercury	.0024	<.001			
28. Molybdenum	.03	.01			
29. Nickel	.005	.01			
30. Nitrate	.22	.10			
31. pH	8.2	8.3			
32. Phosphate, Total	-	.2			
33. Potassium	.4	<1.0			
34. Selenium	<.007	.004			
35. Silica	23	27			
36. Sodium	135	166			
37. Solids, Dissolved	536	650			
38. Strontium	.3	2			
39. Sulfate	84	140			
40. Titanium	.04	.03			
41. Vanadium	.001	<.002			
42. Yttrium	.007	<.002			
43. Zinc	.03	.7			
44. Zirconium	<.007	<.002			
45. Radioactivity					
Gross Alpha (pcl)	8.0	4			
Radium 226*	.1				
Gross Beta (pcl)	0	0			
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC) If TOC >10 mg/l then measure	<1	<1			
Dissolved Organic Carbon		<1			
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-25
GROUNDWATER ANALYSIS
ENVIRONMENTAL BASELINE MONITORING

Well Number: SG-19
Location: NW¼ Sec. 5 73S R96W

Depth: 192-920
Elevation: 6370' G.L.

	DATE ON WHICH SAMPLE TAKEN				
ELEMENT MEASURED--UNITS(mg/1) UNLESS NOTED	11-1-74	4-13-75			
1. Aluminum	.3	.05			
2. Ammonia (Nitrogen)	.14	1.1			
3. Arsenic	< .001	.002			
4. Barium	.2	.2			
5. Beryllium	< .002	<.001			
6. Bicarbonate	1780	1900			
7. Bismuth	< .002	<.001			
8. Boron	2.0	1.6			
9. Cadmium	< .002	<.001			
10. Calcium	6.6	10.			
11. Carbonate	66	55			
12. Cerium	< .002	<.001			
13. Chloride	10	7.2			
14. Chrome, Hexavalent	.002	<.01			
15. Cobalt	< .001	<.002			
16. Conductivity, Specific (μ℧/cc)	2750	2800			
17. Copper	.08	.05			
18. Fluoride	3.1	24			
19. Gallium	.002	.001			
20. Hardness (mg/1 $CaCO_3$)	29	36			
21. Hydroxide	< .1	< .1			
22. Iron	< .05	< .05			
23. Lead	< .008	.009			
24. Lithium	.8	<1.0			
25. Magnesium	2.9	2.5			
26. Manganese	.002	.01			
27. Mercury	.0019	< .001			
28. Molybdenum	.003	.008			
29. Nickel	.002	.02			
30. Nitrate	< .1	< .1			
31. pH	8.4	8.2			
32. Phosphate, Total	< .1	< .1			
33. Potassium	-	2.1			
34. Selenium	< .002	<.001			
35. Silica	9	11			
36. Sodium	755	800			
37. Solids, Dissolved	1810	1850			
38. Strontium	.4	.4			
39. Sulfate	<4	10			
40. Titanium	.03	.1			
41. Vanadium	< .001	.005			
42. Yttrium	< .002	<.001			
43. Zinc	.05	2			
44. Zirconium	.002	.009			
45. Radioactivity					
Gross Alpha (pcl)	7.9	20			
Radium 226*	0.1	0.3			
Gross Beta (pcl)	33	0			
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC)	<1	7			
If TOC >10 mg/l then measure					
Dissolved Organic Carbon					
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-26
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: SG-20
Location: SE¼ Sec. 31 T2S R96W

Depth: 212-987
Elevation: 6358'

	DATE ON WHICH SAMPLE TAKEN				
ELEMENT MEASURED--UNITS(mg/1) UNLESS NOTED	4-14-75				
1. Aluminum	.04				
2. Ammonia (Nitrogen)	1.4				
3. Arsenic	.004				
4. Barium	.3				
5. Beryllium	<.001				
6. Bicarbonate	1790				
7. Bismuth	<.001				
8. Boron	1.6				
9. Cadmium	<.001				
10. Calcium	7.4				
11. Carbonate	85				
12. Cerium	<.001				
13. Chloride	11				
14. Chrome, Hexavalent	<.01				
15. Cobalt	<.004				
16. Conductivity, Specific (μ℧/cc)	2900				
17. Copper	.03				
18. Fluoride	25				
19. Gallium	<.001				
20. Hardness (mg/1 $CaCO_3$)	32				
21. Hydroxide	<.1				
22. Iron	<.05				
23. Lead	.008				
24. Lithium	<1.0				
25. Magnesium	3.3				
26. Manganese	.007				
27. Mercury	<.001				
28. Molybdenum	.03				
29. Nickel	.03				
30. Nitrate	.9				
31. pH	8.4				
32. Phosphate, Total	<.1				
33. Potassium	2.1				
34. Selenium	.002				
35. Silica	10				
36. Sodium	760				
37. Solids, Dissolved	1790				
38. Strontium	.7				
39. Sulfate	10				
40. Titanium	.2				
41. Vanadium	<.001				
42. Yttrium	<.001				
43. Zinc	.04				
44. Zirconium	.01				
45. Radioactivity					
Gross Alpha (pcl)	12				
Radium 226*	.1				
Gross Beta (pcl)	0				
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC) If TOC >10 mg/1 then measure	8				
Dissolved Organic Carbon					
Suspended Organic Carbon					
-Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

TABLE II B-27
GROUNDWATER ANALYSIS
BASELINE MONITORING

Well Number: SG-21
Location: SE¼ Sec. 13 T3S R97W

Depth: 156' - 1036'
Elevation: 6811' G.L.

DATE ON WHICH SAMPLE TAKEN

ELEMENT MEASURED--UNITS(mg/1) UNLESS NOTED	4-15-75				
1. Aluminum	.06				
2. Ammonia (Nitrogen)	0.4				
3. Arsenic	.006				
4. Barium	.1				
5. Beryllium	<.002				
6. Bicarbonate	470				
7. Bismuth	<.002				
8. Boron	0.4				
9. Cadmium	<.002				
10. Calcium	30				
11. Carbonate	24				
12. Cerium	<.002				
13. Chloride	2.9				
14. Chrome, Hexavalent	<.01				
15. Cobalt	<.003				
16. Conductivity, Specific (µ℧/cc)	1020				
17. Copper	.005				
18. Fluoride	8.6				
19. Gallium	.002				
20. Hardness (mg/1 $CaCO_3$)	160				
21. Hydroxide	<.1				
22. Iron	<.05				
23. Lead	.01				
24. Lithium	<1.0				
25. Magnesium	21				
26. Manganese	.03				
27. Mercury	<.001				
28. Molybdenum	.02				
29. Nickel	.02				
30. Nitrate	0.6				
31. pH	8.2				
32. Phosphate, Total	0.2				
33. Potassium	2.1				
34. Selenium	.003				
35. Silica	21				
36. Sodium	200				
37. Solids, Dissolved	650				
38. Strontium	2				
39. Sulfate	110				
40. Titanium	.03				
41. Vanadium	.003				
42. Yttrium	<.002				
43. Zinc	.1				
44. Zirconium	<.001				
45. Radioactivity					
Gross Alpha (pcl)	9.2				
Radium 226*	.1				
Gross Beta (pcl)	0				
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC) If TOC >10 mg/1 then measure Dissolved Organic Carbon	2				
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

Table II B-28 gives minimum, maximum and mean concentrations for the elements monitored in the alluvial wells. For many of the elements there is no specific numerical value available since the data are reported as being less than the detectable limit. The trace elements are a good example where the analytical technique used cannot detect the small amount of element present.

Geologists and hydrologists commonly analyze the occurrence of major anions and cations by plotting a selected set of these in a fixed order so that a closed polygon (called a Stiff diagram) is formed by connecting the plotted points with straight lines. A time dependent change in the shape of the characteristic polygon often can then be used as a tool to hypothesize seasonal fluctuations, sampling abnormalities, or other causal events. Stiff diagrams for five wells have been completed in time for inclusion in this report; however, no attempts have been made yet to compare shapes over time and hypothesize causal relationships. These diagrams are included as Figure II B-2.

II B-6 Water Quality - Aquifer Pump Tests

Three water samples were collected from the central pumped well, AT-1, during the Lower Aquifer Pumping Test. Also, water was jetted from SG-1a during the "mini-pump test" and three water samples were collected for analysis. Data are summarized in Tables II B-29 and II B-30. Several additional samples were collected from AT-1 on a periodic basis for limited analysis of fluoride and boron only (Table II B-31).

II B-7 Aquifer Data - Jetting Tests

Since most of the drilling on Tract C-b has already been completed and reported in Quarterly Report #1 and Quarterly Report #2, there are no jetting test aquifer data to report in this Summary Report. Small quantities of water (generally less than 10 gpm) were jetted from SG-1a in association with the drillstem tests run on it. All of the SG-1a jetting test data will be found in the section on drillstem tests and multipacker tests in Quarterly Report #3, Section II B-8.

II B-8 Aquifer Data - Drillstem Tests, Multipacker Tests and Mini-Pump Tests

Drillstem Tests

Data filed in Quarterly Report #3 include drillstem test data from SG-17, SG-20, and SG-21 (Refer to Tables II B-32, and II B-33 for a listing of these drillstem tests). Those parties interested in the development and significance of the drillstem test program are referred to Quarterly Report #2, Volume II, Page II B-252 ff.

(Text Continued on Page 61)

TABLE II B-28

WATER QUALITY ANALYSIS
ALLUVIAL WELLS **
MIN, MAX, & MEAN
(November 1974 & April 1975)

	Element Measured (mg/l unless noted)	MIN	MAX	MEAN		
1.	Aluminum	.01	3.0	.32		
2.	Ammonia	*	5.2			
3.	Arsenic	*	.05			
4.	Barium	.02	0.6	.09		
5.	Beryllium	*	*			
6.	Bicarbonate	436	670	527		
7.	Bismuth	*	*			
8.	Boron	*	5.2			
9.	Cadmium	*	.12			
10.	Calcium	25	105	56		
11.	Carbonate	0	24	4		
12.	Cerium	*	*			
13.	Chloride	1	32	10.4		
14.	Chrome, Hexavalent	*	*			
15.	Cobalt	*	.05			
16.	Conductivity, Specific (uv/cc)	1080	1790	1365		
17.	Copper	.005	.2	.040		
18.	Fluoride	.2	5.0	1.22		
19.	Gallium	*	.03			
20.	Hardness, Total	350	560	450		
21.	Hydroxide	*	*			
22.	Iron	.05	9.4	1.00		
23.	Lead	*	.2			
24.	Lithium	*	*			
25.	Magnesium	47	120	76		
26.	Manganese	.003	2.3	.528		
27.	Mercury	.0001	.048	.0058		
28.	Molybdenum	.003	.1	.030		
29.	Nickel	.002	.1	.027		
30.	Nitrate	.1	9.1	2.70		
31.	pH	7.3	8.5	7.9		
32.	Phosphate, Total	.1	1.1	.17		
33.	Potassium	1.0	4.3	1.99		
34.	Selenium	*	.06			
35.	Silica	12	39	19		
37.	Sodium	110	730	230		
38.	Solids, Dissolved	840	1330	1048		
39.	Strontium	.2	10	2.4		
40.	Sulfate	225	530	410		
41.	Titanium	.01	2.0	.43		
42.	Vanadium	.002	.2	.020		
43.	Yttrium	*	.2			
44.	Zinc	.02	2.0	.46		
45.	Zirconium	.002	.04	.010		
46.	Radioactivity Gross Alpha (pcl)	1.6	9.6	4.2		
	Radian 226*					
	Gross Beta (pcl)					
	Thorium 230*					
	Uranium*					
47.	Total Organic Carbon (TOC) If TOC > 10 mg/l then measure Dissolved Organic Carbon	1	9	6		
	Suspended Organic Carbon					
	Phenols					
	Sulfate, Acid Extraction					
	Nitrogen, Base Extraction					

* Omitted because quantity below detectable limits of analytical method.
** Two samples each from nine wells.

FIGURE II B-2

COMPARISON OF STIFF DIAGRAMS OF SELECTED WELLS ANALYSIS AT SIX-MONTH INTERVALS

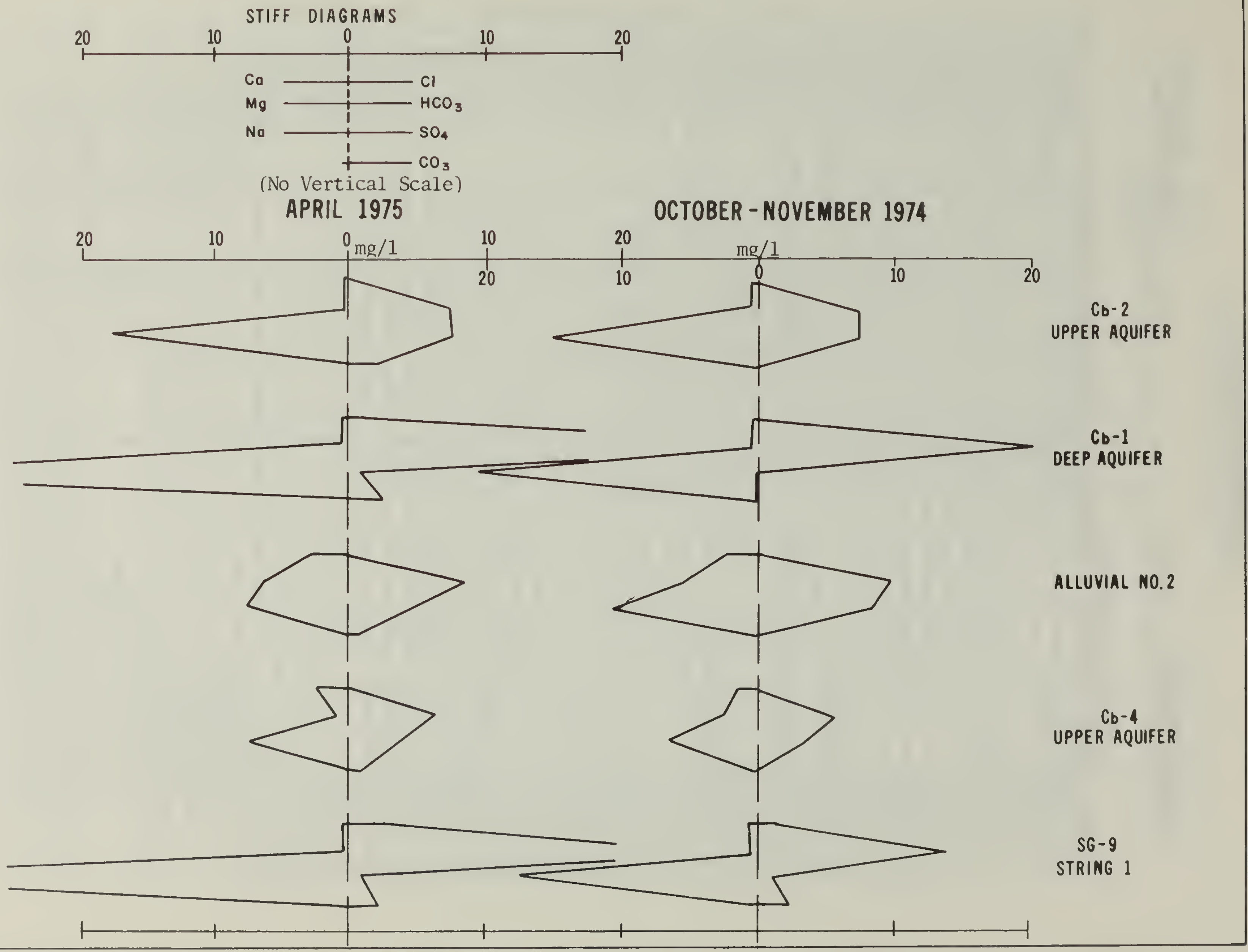


TABLE II B-29
GROUNDWATER ANALYSIS
WATER FROM DRILLSTEM TESTS

Well Number: SG-1A
Location: SE¼ Sec. 2, T3S R97W

Depth: See Footnotes
Elevation: 6426

SAMPLES

ELEMENT MEASURED--UNITS (mg/l) UNLESS NOTED	(a)	(b)	(c)		
1. Aluminum					
2. Ammonia (Nitrogen)					
3. Arsenic					
4. Barium					
5. Beryllium					
6. Bicarbonate	1632	1127	1418		
7. Bismuth					
8. Boron	11	4	11		
9. Cadmium					
10. Calcium	5.2	4.8	6		
11. Carbonate	58	23	32		
12. Cerium					
13. Chloride	172	5	69		
14. Chrome, Hexavalent					
15. Cobalt					
16. Conductivity, Specific (μ℧/cc)	2750	1580	2200		
17. Copper					
18. Fluoride	19	20	17		
19. Gallium					
20. Hardness (mg/l $CaCO_3$)	40	32	38		
21. Hydroxide					
22. Iron	<.05	<.05	<.05		
23. Lead					
24. Lithium	.5	.1	.01		
25. Magnesium	5.5	3.4	5.2		
26. Manganese					
27. Mercury					
28. Molybdenum					
29. Nickel					
30. Nitrate	1.3	.9	.3		
31. pH	8.9	8.7	8.8		
32. Phosphate, Total					
33. Potassium	.3	1.3	2.4		
34. Selenium					
35. Silica	10	17	10		
36. Sodium	816	460	640		
37. Solids, Dissolved	1905	1103	1506		
38. Strontium					
39. Sulfate	8	12	19		
40. Titanium					
41. Vanadium					
42. Yttrium					
43. Zinc					
44. Zirconium					
45. Radioactivity					
Gross Alpha (pcl)					
Radium 226*					
Gross Beta (pcl)					
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC) If TOC >10 mg/l then measure Dissolved Organic Carbon					
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

(a) DST 4 (909-938 feet)
(b) DST 8 (1125-1180 feet)
(c) DST 10 (968-1010 feet)

TABLE II B-30
GROUNDWATER ANALYSIS
LOWER AQUIFER PUMPING TEST AT-1

Well Number: AT-1
Location: SW¼ Sec. 7 T3S R96W

Depth: see footnotes
Elevation: 6909 G.L.

DATE ON WHICH SAMPLE TAKEN

ELEMENT MEASURED--UNITS(mg/1) UNLESS NOTED	(a)	(b)	(c)		
1. Aluminum					
2. Ammonia (Nitrogen)					
3. Arsenic					
4. Barium					
5. Beryllium					
6. Bicarbonate	711	734	755		
7. Bismuth					
8. Boron	3	3	3		
9. Cadmium					
10. Calcium	4.2	3.8	3.8		
11. Carbonate	24	16	11		
12. Cerium					
13. Chloride	5	5	5		
14. Chrome, Hexavalent					
15. Cobalt					
16. Conductivity, Specific (μ℧/cc)	1120	1110	1110		
17. Copper					
18. Fluoride	19	19	19		
19. Gallium					
20. Hardness (mg/1 $CaCO_3$)	24	22	24		
21. Hydroxide					
22. Iron	0.6	≤.05	<.05		
23. Lead					
24. Lithium	.05	.05	.04		
25. Magnesium	2.7	2.6	2.7		
26. Manganese					
27. Mercury					
28. Molybdenum					
29. Nickel					
30. Nitrate			.6		
31. pH	9.0	8.8	8.6		
32. Phosphate, Total	<.1	3	<.1		
33. Potassium	1	.9	.9		
34. Selenium					
35. Silica	13	13	13		
36. Sodium	320	310	310		
37. Solids, Dissolved	752	747	750		
38. Strontium					
39. Sulfate	12	8	12		
40. Titanium					
41. Vanadium					
42. Yttrium					
43. Zinc					
44. Zirconium					
45. Radioactivity					
Gross Alpha (pcl)					
Radium 226*					
Gross Beta (pcl)					
Thorium 230**					
Uranium **					
46. Total Organic Carbon (TOC) If TOC >10 mg/1 then measure Dissolved Organic Carbon					
Suspended Organic Carbon					
Phenols					
Sulfate, Acid Extraction					
Nitrogen, Base Extraction					
Polycyclic Aromatics					

* Required if gross alpha is greater than 4 picocuries per liter (pcl).
** Required if gross beta is greater than 100 picocuries per liter (pcl).

(a) jet test sample at 1700 ft. 1-28-75
(b) 3.5 hours of pumping at 1700 ft. 2-5-75
(c) 21 hours of pumping after restart 1700 ft. 2-16-75

TABLE II B-31

FLUORIDE & BORON IN LOWER ZONE

AT-1 PUMPING TEST WATER

Date - 1975	1/20	2/5	2/23	2/24	2/25	2/27	2/28	3/1	3/3	3/5	3/7	3/19
Fluoride (ppm)	18.0	18.1	20.0	20.1	20.4	18.4	20.4	20.16	19.0	20.0	21.2	23.2
Boron (ppm)	0.65	0.88	1.15	1.10	1.13	1.2	1.6	1.42	2.58	2.02	2.18	2.00

TABLE II B-32
COREHOLE SG-17
PRESSURE-POTENTIAL CHARTS
DRILLSTEM TESTS*

DST No.	Packer Setting	Tester/Zone
3	822-869	Johnston Lower
4	866-919	Johnston Upper
5	919-970	Johnston Lower Johnston Middle Johnston Upper
6	967-1017	Johnston Lower Johnston Upper
8	1066-1116	Johnston Lower Johnston Upper
9	1116-1166	Johnston Upper
10	1164-1212	Sperry Sun
11	1200-1224	Johnston Lower Johnston Upper
13	1224-1250	Johnston Lower Johnston Upper
14	1251-1280	Johnston Lower
15	1280-1309	Johnston Upper
16	1308-1336	Sperry Sun Johnston Upper
13	1373-1419	Johnston Lower
19	1423-1470	Sperry Sun Johnston Lower
20	1423-1470	Johnston Lower
22	1428-1522	Johnston Upper
23	1514-1572	Johnston Upper
25	1618-1670	Johnston Lower
26	1668-1720	Johnston Lower Johnston Upper
27	1711-1770	Johnston Lower
28	1764-1768	Johnston Lower
30	1869-1920	Sperry Sun Johnston Upper
31	1918-1970	Johnston Lower
32	1968-2020	Sperry Sun
33	2018-2070	Johnston Lower
34	2120-2170	Johnston Lower Johnston Upper
35	2220-2270	Sperry Sun Johnston Lower
36A	2320-2370	Sperry Sun Johnston Upper
36B	2315-2370	Johnston Lower Johnston Upper
37	2395-2460	Sperry Sun Johnston Upper

* Other charts were reported in Quarterly Report #2.

TABLE II B-33

COREHOLE SG-20
PRESSURE-POTENTIAL CHARTS
DRILLSTEM TESTS*

DST No.	Packer Setting	Tester/Zone
1	896-945	Sperry Sun
2	945/986	Sperry Sun Johnston/Lower

COREHOLE SG-21
PRESSURE-POTENTIAL CHARTS
DRILLSTEM TESTS*

DST No.	Packer Setting	Tester/Zone
1	1000-1036	Johnston/Lower
2	950-1000	Sperry Sun Johnston/Lower Johnston/Upper

* Other charts were reported in Quarterly Report #2.

In late December, 1974, drillstem tests were run on coreholes SG-1 and SG-8. These were reported in _Quarterly Report #2_, Page II B-45. In addition, laboratory analyses of water collected during the tests were included and can be found in the water quality summary tables, Pages II B-48 and II B-52, _Quarterly Report #2_. Technical reports for these two drillstem tests, inadvertently omitted from _Quarterly Report #2_, are included in _Quarterly Report #3_ to complete the data presentation.

For the purposes of analyzing vertical permeability on the C-b Tract, additional drillstem tests were made on SG-1 and SG-1a. The data on these tests are reported in the twin-hole test program.

Twin Hole Test Program at SG-1a

During January and early February of 1975, a series of drillstem tests and jetting tests were conducted on Tract C-b at corehole SG-1. The tests were designed to obtain information to be used in the analysis of the permeability across geologic strata believed to be aquitards.* The term "aquitard" refers to layers of rock or sediment which have a low permeability and which retard or prevent movement of water across them. Validation of the belief that aquitards are present is considered extremely important since mining engineers wish to control the amount of water entering an underground mine. Part of the analysis and validation occurs in the field but the major analysis is developed by modeling and computer simulations, as discussed below.

SG-1a, located approximately 100 feet from SG-1, was drilled down to the uppermost potential aquitard. Pressure bombs were installed in both wells, and in the zones isolated by packers. They were set to monitor water levels within and above potential aquitards. Water was jetted from SG-1a for a period of 24 hours from each isolated zone. The well was then deepened and the test rerun through a succession of 10 intervals. Relatively small amounts of water were produced because of the small thickness of the packed off intervals.

Data from pressure bombs above and below the packers gave information on packer success or failure and also on vertical permeability. Computer modeling of the test situation indicated that the barriers have permeabilities less than 0.1 millidarcy (md) in the vicinity of SG-1 and SG-1a.

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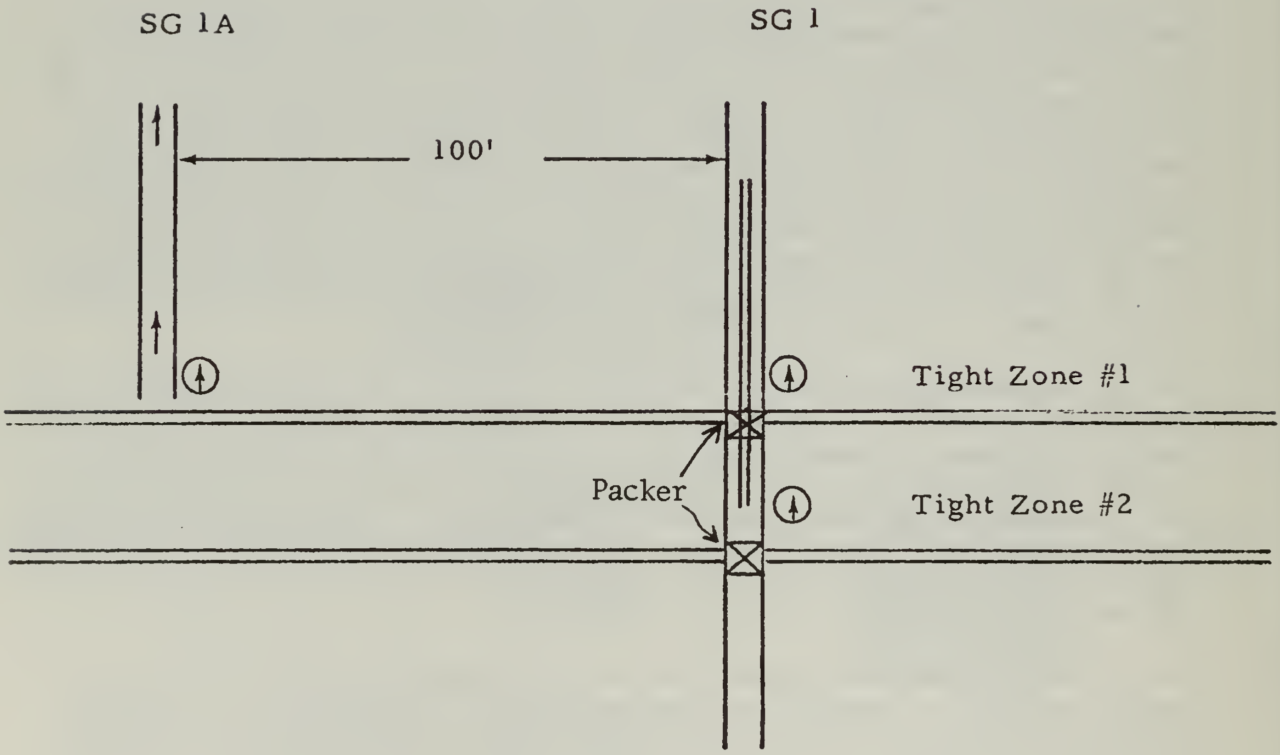
* Several rich, unfractured oil shale bands were identified in the core from SG-1 which appeared to be impermeable zones above the Mahogany.

FIGURE II B-3

Proposed Min-Pump Test Configuration



Theoretical Evaluation Using Computer Simulation

A mini-pump test program using wells SG-1 and SG-1a was suggested and implemented. The initial plan was to jet well SG-1a and measure the response in well SG-1 above and below a barrier (See Figure II B-3). Theoretical calculations on Tract C-b were carried out to determine the relative accuracy of measuring the vertical permeability of a barrier using this approach. Distance between wells and rate of pumping were the two obvious parameters to investigate. Table II B-34 lists rock properties used for these calculations. Layer No. 6 was the barrier. SG-1a was pumped from layers 3, 4 and 5 and pressures were recorded in layer 5 at SG-1a and in layers 5 and 7 at SG-1.

Figure II B-4 shows some results of this work. It can be seen that if the pumping rate were 10,000 barrels of water per day (1 barrel equals 42 gallons) measurable pressure differentials could be expected across barriers whose permeabilities were as high as 1 to 2 md. Figure II B-5 shows that with a production rate of 3,000 BWPD, measurable pressure differentials would occur if the barrier permeability was less than about 0.5 md. Figure II B-6 shows extrapolations of the results of these calculations to lower production rates. It can be seen at low rates (less than 500 BWPD) that the pressure differential across the barrier for a one md vertical permeability is practically the same as before the start of the test. Vertical permeabilities from 0.1 md and lower could be detected barring severe open hole effects but could not be calculated accurately. Figure II B-7 illustrates the influence that distance between the pumping and observation wells has upon pressure response. Table II B-35 summarizes the actual mini-pump tests as distinguished from the computer simulation.

As indicated in Table II B-35, a series of ten tests were conducted in SG-1a. Of these, Test #10 illustrates the most significant aspects of the twin hole program. Data presented in Figure II B-4 in the proceeding evaluation indicated that it could be possible to measure a pressure contrast across barriers and this contrast would be amplified with lower vertical permeability values. However, Figure II B-6 indicated that at lower rates the local pressure differential becomes small.

The rates used in the mini-pump tests were low, approximately 10 gal/min or 350 BWPD. The configuration of Test #10 is shown in Figure II B-8. Table II B-35 lists rock properties used to evaluate the performance of Test #10. Figure II B-9 shows results of that evaluation. The pressure change measured between packers in well SG-1 was matched, assuming zero vertical permeability in the barriers. Then additional runs were made assuming vertical permeabilities of 0.001, 0.01, 0.1 and 1.0 md. Layers 5 and 9 are the positions of the upper and lower gauges, respectively in SG-1. It can be seen that vertical barrier permeabilities of 0.001 and 0.01 could not be distinguished from zero because of the low response in layers 5 and 9. A vertical permeability of 0.1 could possibly be detected if hole effects did not mask out the 3 psi response. If the vertical permeabilities of these zones were as high as one md, readings of all three gauges in SG-1 would show nearly the same pressure change and appear to be a packer failure.

TABLE II B-34

ROCK PROPERTIES FOR THEORETICAL MINI-PUMP CALCULATIONS

	Layer No.	Permeability, md.		Porosity %	Layer Thickness, ft.
		Horizontal	Vertical		
	1	10000.	10000.	1000.	2.
	2	20.	10.	20.	410.
	3	100.	50.	20.	100.
	4	100.	50.	20.	450.
	5	100.	50.	20.	10.
Tight Zone →	6	*	*	0.1	**
	7	100.	50.	20.	10.
	8	100.	50.	20.	50.
	9	100.	50.	20.	100.
	10	100.	50.	20.	450.

* Varied from 0.01 to 5.0 md.

** Used values of 3.0 and 5.0 feet

Figure II B-4 Effect of Permeability on Δp Across Barrier

Thickness of barrier = 3 feet
Radial distance from well = 100 ft.
Rate = 10000 BPD

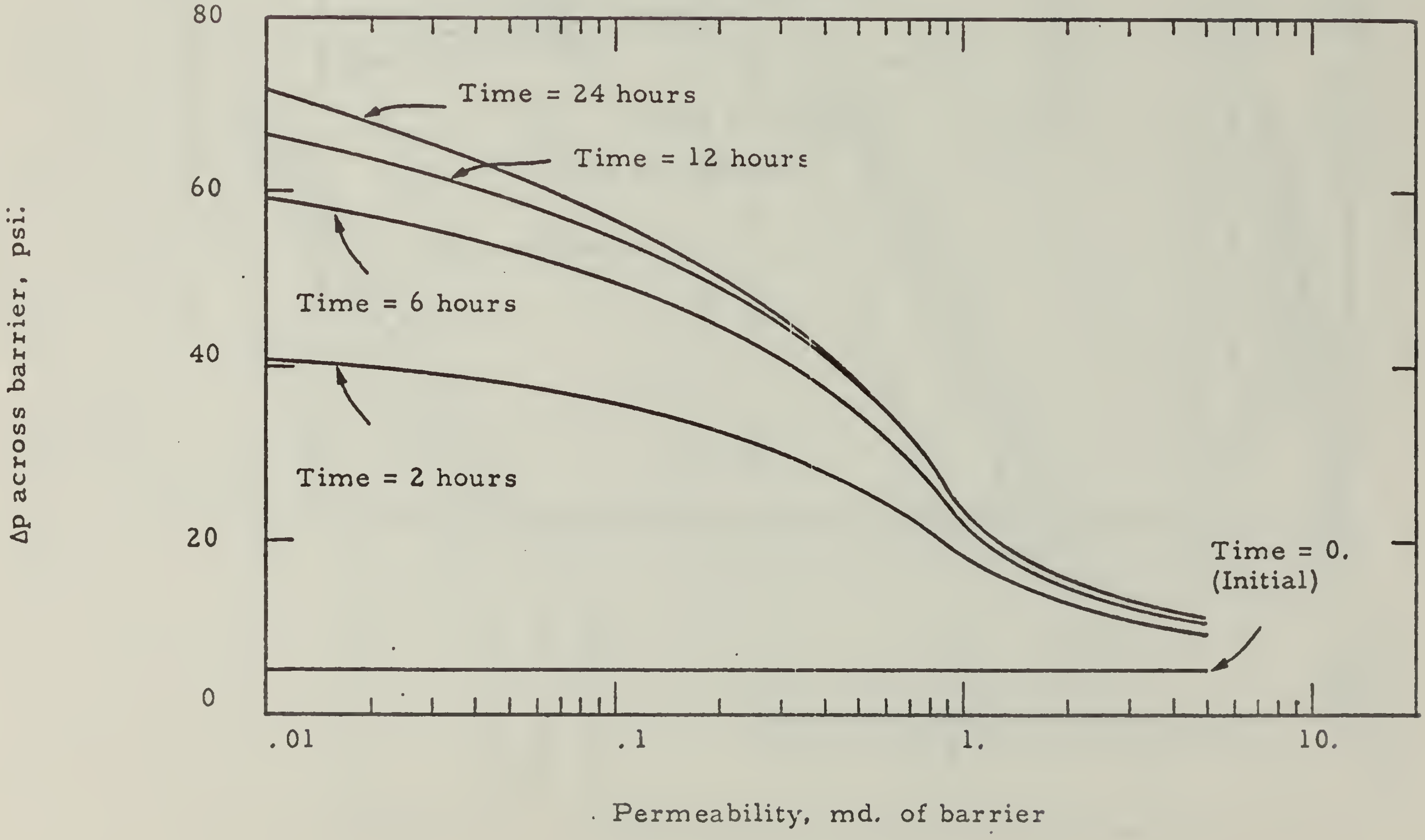


FIGURE II B-5 Effect of Permeability on Δp Across Barrier

Thickness of barrier = 3.0 ft.
Radial distance from well = 100. ft.
Rate = 3000. BPD

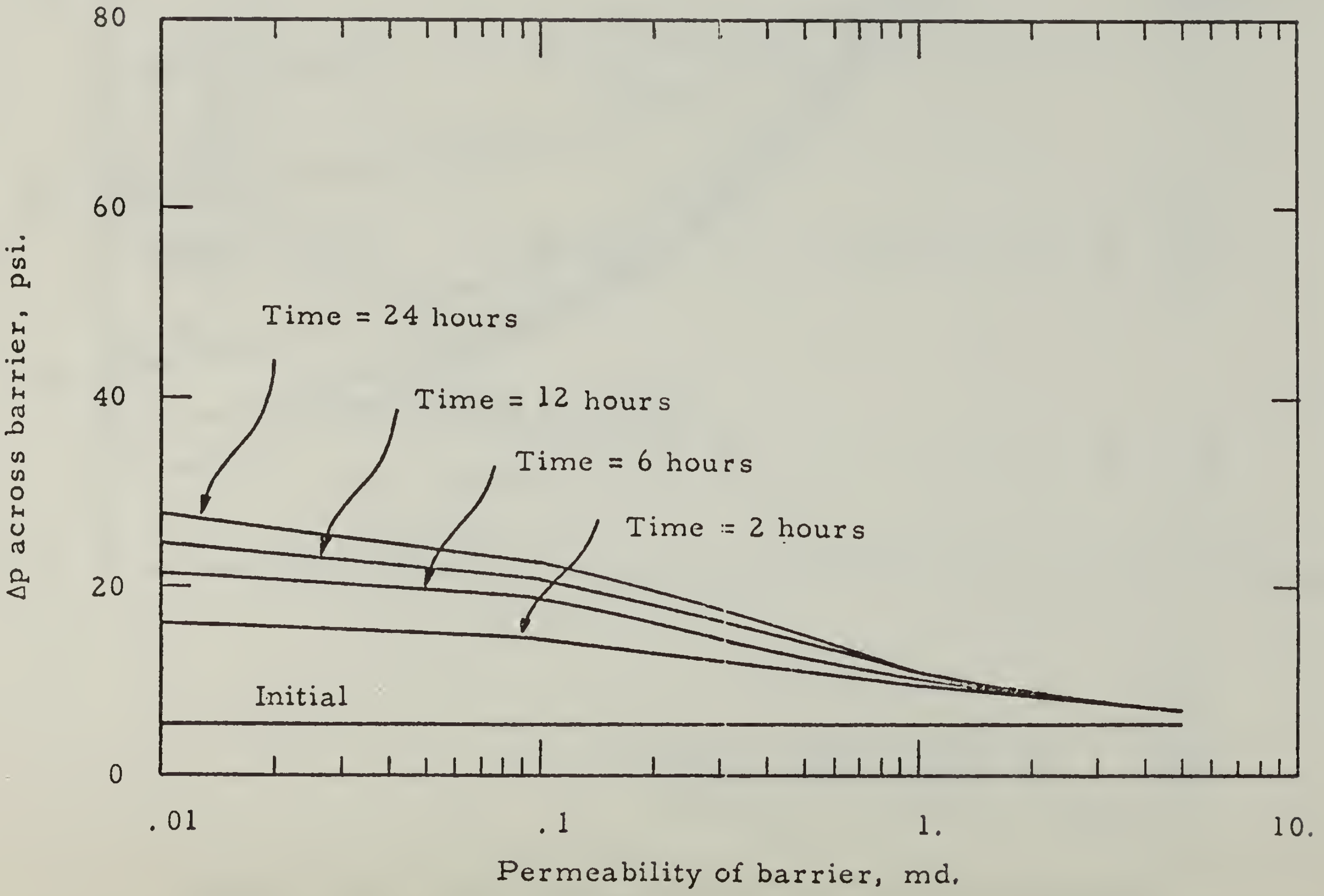


FIGURE II B-6

Effect of Rate on Δp Across Barrier

Thickness of barrier = 3.0 feet
Radial distance from well = 100. feet

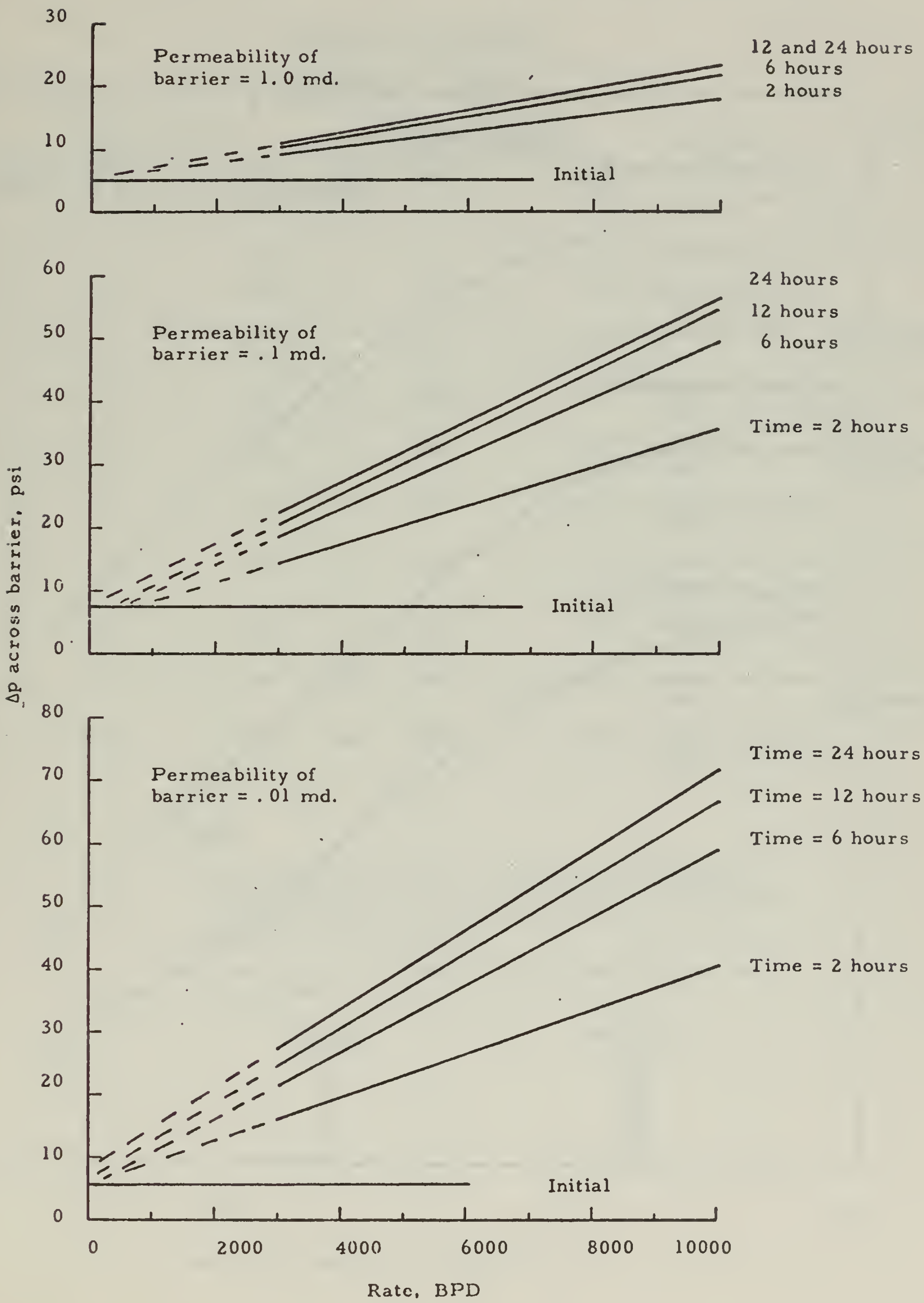


FIGURE II B-7

Influence of Distance From Well on Δp in 24 Hours

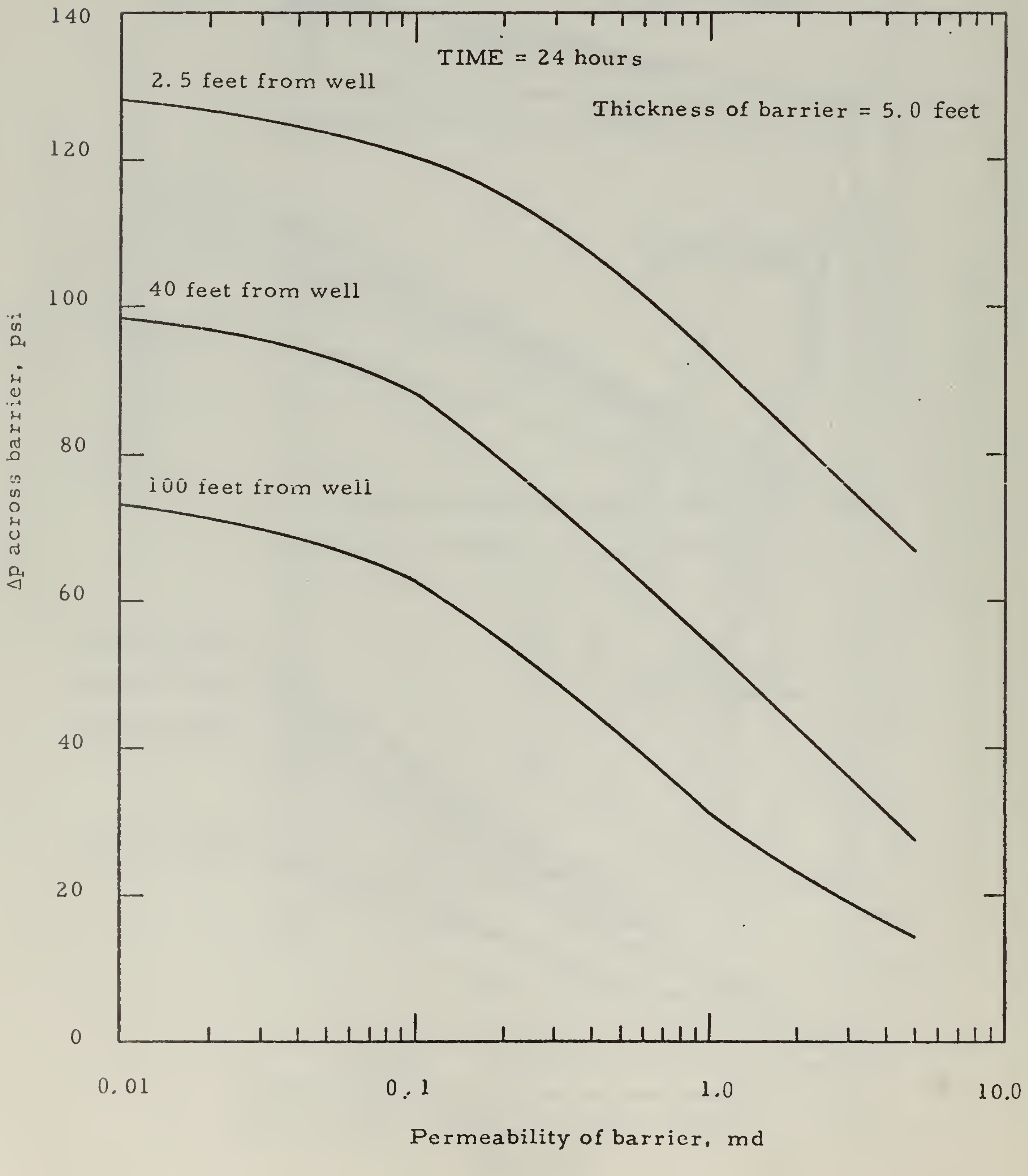


Table II B-35

SUMMARY OF MINI PUMP TESTS

BOREHOLES SG - 1/SG - 1A

Min. Test No.	Borehole SG - 1 Depth of Packers (Ft.) Upper	Borehole SG - 1 Depth of Packers (Ft.) Lower	Borehole SG - 1 Borehole Depth (Ft.)	Borehole SG - 1A Depth of Packers (Ft.) Upper	Borehole SG - 1A Depth of Packers (Ft.) Lower	Borehole SG - 1A Borehole Depth (Ft.)	Production Zone	Comments
1	907	944	2525	-	-	900	Above rich Zone 1	
2	944	968	2525	-	-	938	Above rich Zone 2	
3	907	944	2525	-	-	938	Above rich Zone 2	Packer leakage repeated as Min 4
4	907	944	2525	-	909	938	Between rich Zones 1 and 2	
5	944	968	2525	-	947	969	Between rich Zones 2 and 3	Packer leakage repeated as Min 6
6	944	968	2525	-	947	969	Between rich Zones 2 and 3	
7	968	1000	2525	-	968	1001	Between rich Zones 3 and 4	
8	1123	1166	2525	-	1125	1180	Between rich Zones 5 and 6	
9	969	1001	2525	968	1002	1180	Between rich Zones 3 and 4	Packer malfunction repeated as Min 10
10	968	1008	2525	969	1009	1180	Between rich Zones 3 and 4	

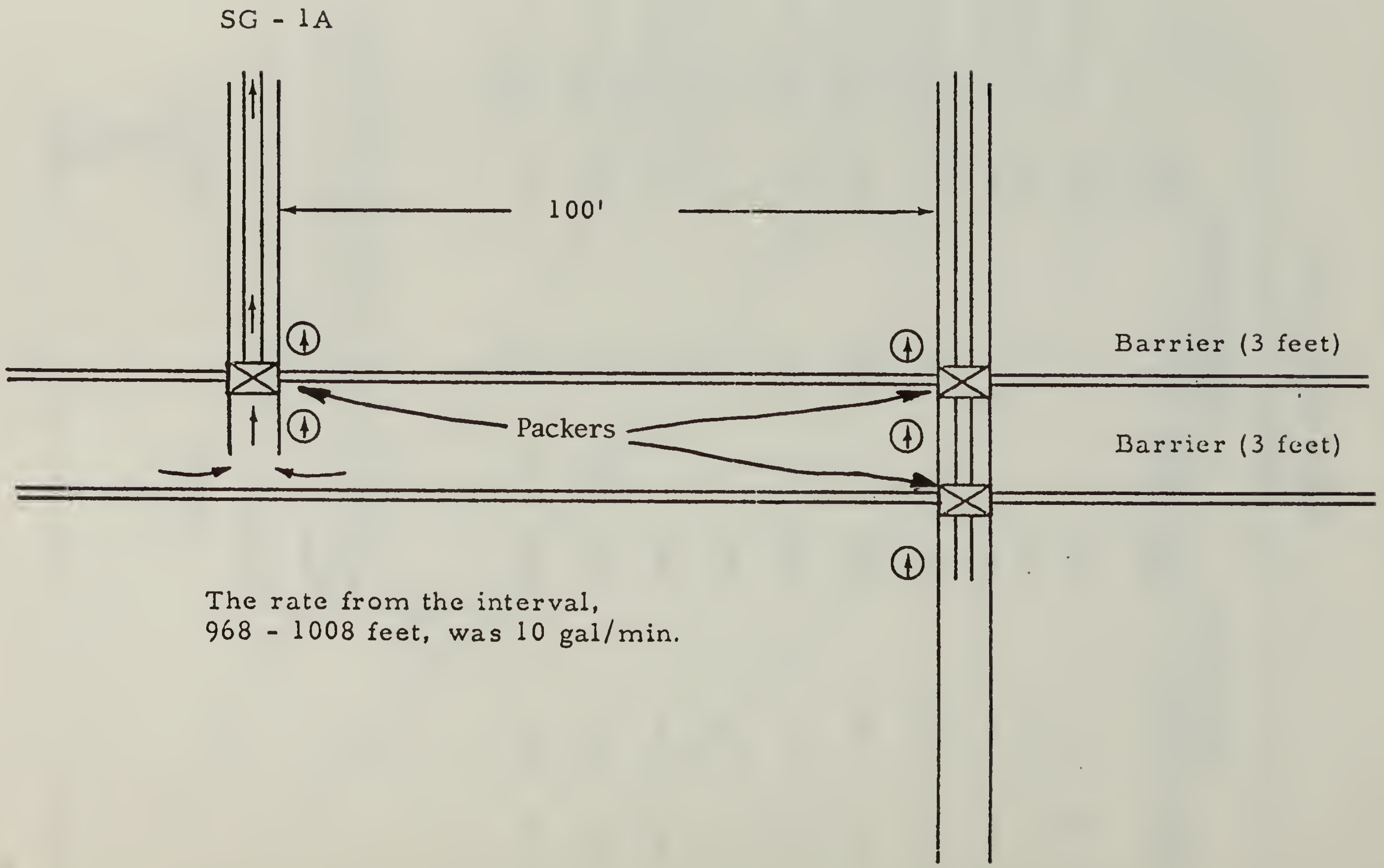
NOTES

1. Jetting conducted in SG - 1A from within the production zone indicated; pressure response in the production zone, above and below it, measured in Borehole SG - 1, 100 ft. distant.

2. "Rich Zones" are located at the following depths in the boreholes:

Rich Zone	Depth (Ft.)
1	907
2	944
3	968
4	1008
5	1123
6	1180

Figure II B-8   Mini Pump Test No. 10 Configuration



The rate from the interval,
968 - 1008 feet, was 10 gal/min.

TABLE II B-36

MODELING DATA

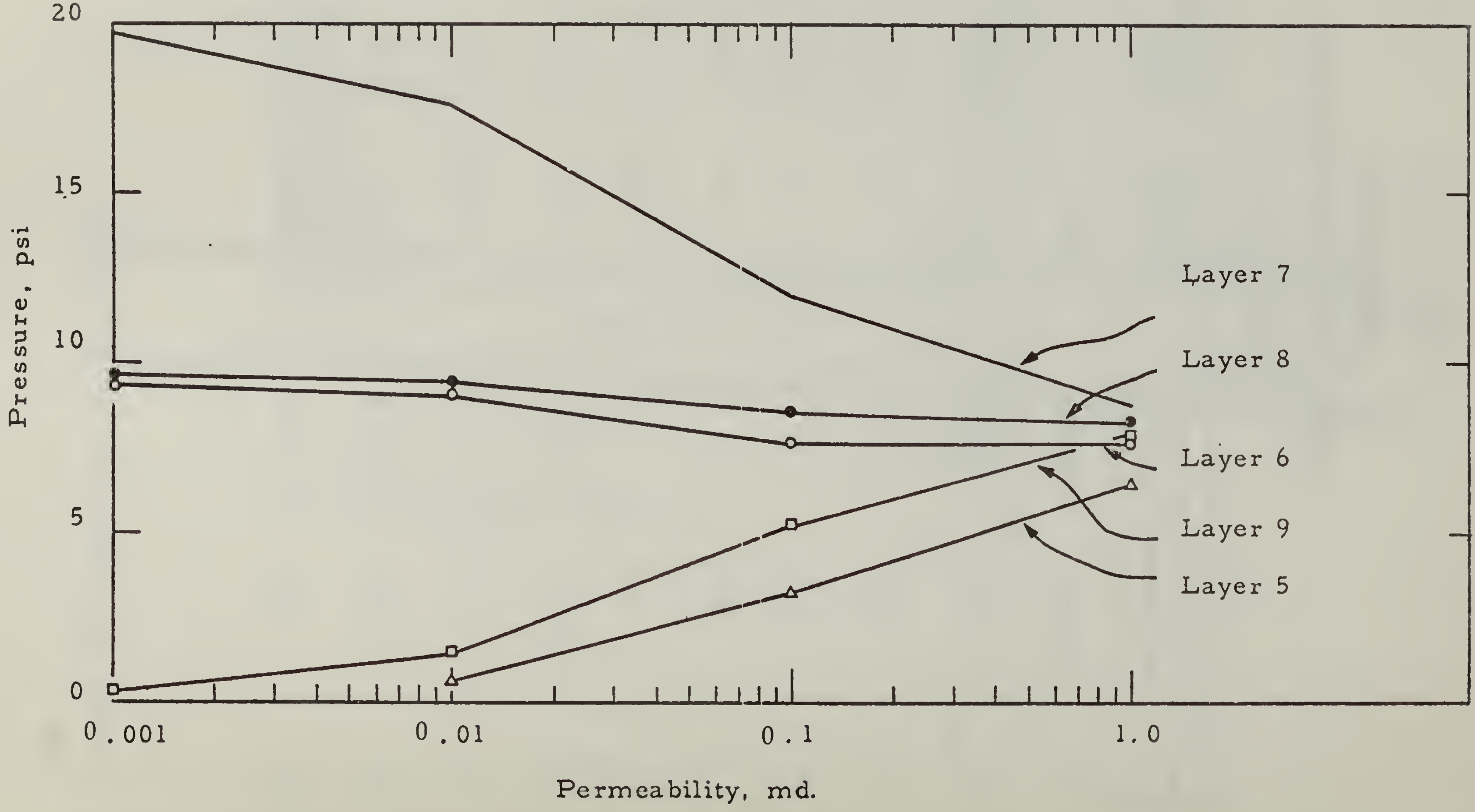
RESERVOIR SIMULATION CONSTRAINTS

Mini-Pump Test No. 10

Layer No.	Permeability, md. Horizontal	Vertical	Porosity Fraction	Thickness Feet	Cumulative Depth, Feet
1	10000.0	10000.0	1000.0	2.0	2.0
2	10.0	10.0	0.2	410.0	412.0
3	11.0	11.0	0.2	455.0	867.0
4	12.7	12.7	0.2	53.0	920.0
5	34.0	34.0	0.2	45.0	965.0
6	1.0*	1.0*	0.001	3.0	968.0
7	150.0	50.0	0.2	40.0	1008.0
8	1.0*	1.0*	0.001	3.0	1011.0
9	19.9	19.9	0.2	14.0	1025.0
10	8.0	8.0	0.2	345.0	1370.0

* Varied this value from 0.001 to 1.0 md.

FIGURE II B-9 Mini-Pump Test No. 10
Effect of Barrier Permeability on Δp


Pressure Effect at End of Test

No Hole Effect

To obtain qualitative information of the hole effect on the response gauges in SG-1, several cases were simulated with a high vertical permeability zone above and below the packers in SG-1. The pressure drop was reduced by more than half in the cases studied.

Since the packers held well in this test (neither the upper or lower gauge values varied one psi during the drawdown), the only conclusion to make is that the vertical permeabilities of these two barriers appear to be less than 0.1 md.

II B-9 Aquifer Data - Pumping Tests

Summary Report #2 contains a detailed description of the objectives and history of the upper zone phase of the aquifer pumping test at AT-1. It was stated that the upper zone test was terminated in mid-January when a drilling rig was brought back to the site, and AT-1 deepened. This action, in fact, began the preparation for testing the lower zone. The test well AT-1 was drilled to the base of the mining zone, and casing was installed and cemented in place. The well was then drilled an additional 270 feet, downward into the "lower zone aquifer" (Figure II B-10). A pump with water production capability of 150 gallons per minute was installed at a depth of 1430 feet below ground surface. (It was determined during the deepening of AT-1 that the lower aquifer could not sustain rates in excess of 150 gpm. The upper aquifer, by comparison, was capable of yielding greater than 400 gpm.)

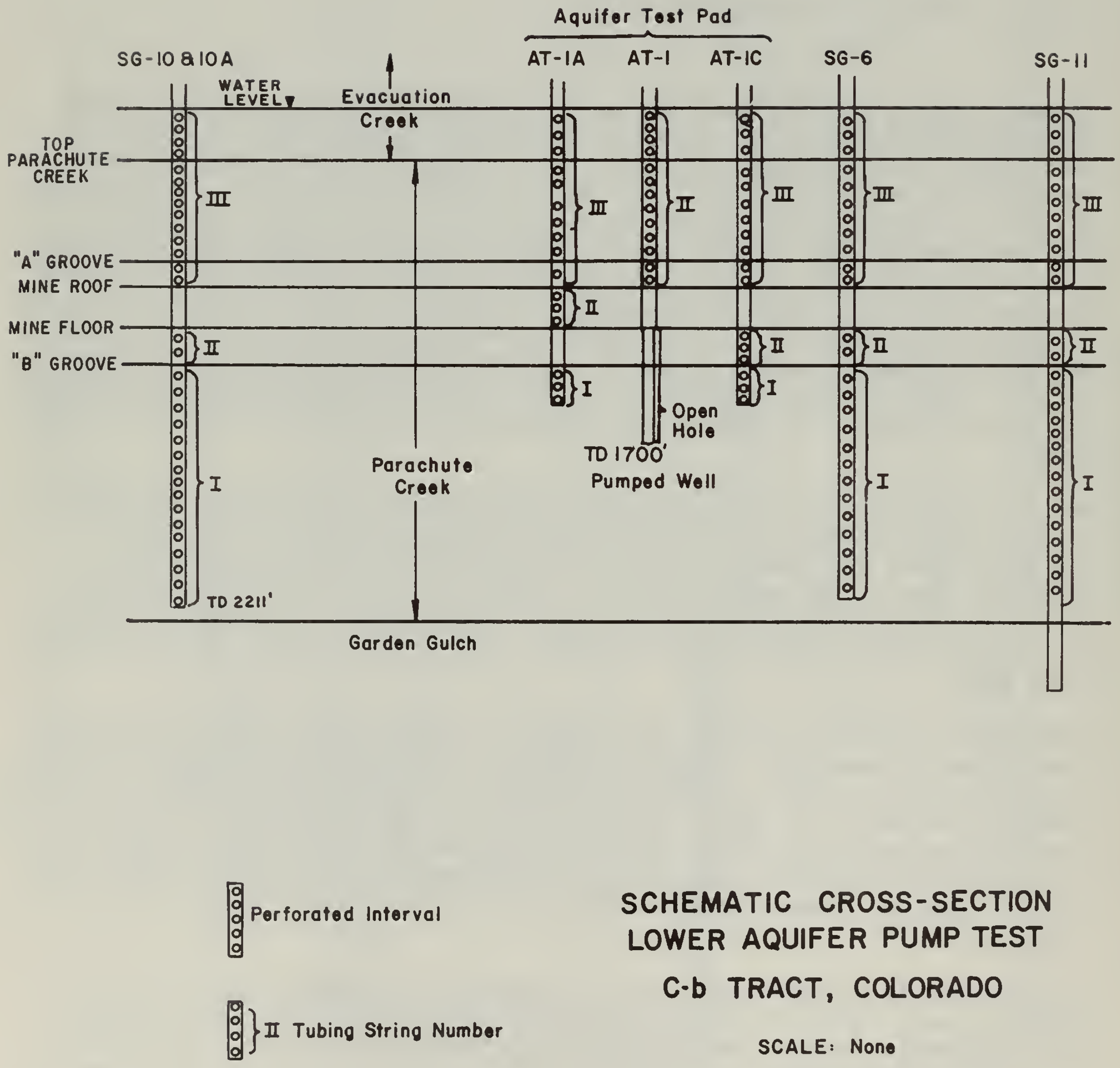
Water produced during the deepening operation had a relatively low dissolved solids content, 1500 mg/l and a fluoride content of approximately 20 mg/l. This was similar in character to waters directly above the Mahogany zone in the upper aquifer. Durint the test, fluoride and boron levels averaged 20 mg/l and 1 to 2 mg/l, respectively. During the lower zone test, the dissolved solids content of production water never exceeded 1200 mg/l.

Background pressure readings were taken for several days before the test was actually commenced. Almost immediately, however, an equipment problem forced a restart. After restart, the test well maintained a rate of approximately 120 gpm for 17 days. At that time, the generator unit failed and the initial pumping phase of the test was terminated. A recovery period lasted for eight days and was followed by a pulse-pumping phase before final shut-in. I complete chronology of events for the lower aquifer test is given in Table II B-37.

An overview of pressure response data generated during the lower aquifer test suggests that strong anisotropic or directional permeability exists. The orientation of this anisotropy in the lower aquifer can be described as following the general direction of AT-1 to SG-6. This is approximately normal to the directional permeability shown in the upper zone test. Computer analysis has not been initiated as yet because pressure data are still being reduced and will not be available in suitable format for some time.

(Text Continued on Page 76)

FIGURE II B-10



SCHEMATIC CROSS-SECTION
LOWER AQUIFER PUMP TEST
C-b TRACT, COLORADO

SCALE: None

TABLE II B-37
LOWER AQUIFER PUMP TEST

Sequence of Events

6-hour surge test drawdown (systems test) 2-5-75 (12 P.M.-6 P.M.)

surge test recovery 2-5-75 (6 P.M.) to 2-15-75 (5:20 P.M.)

Original start of drawdown 2-15-75 (5:20 P.M.) to 2-17-75 (12:45 P.M.)

(generator failure)

Recovery Period 2-17-75 (12:45 P.M.) to 2-21-75 (12:00 P.M.)

Initial drawdown 2-21-75 (12:00 P.M.) to 3-10-75 (10:00 A.M.)

17 days pumping

Initial recovery 3-10-75 (10:00 A.M.) to 3-18-75 (12:00 P.M.)

8 days shut in

Pulse test drawdown 3-18-75 (12:00 P.M.) to 3-26-75 (12:00 P.M.)

8 days pumping

Final recovery 3-26-75 (12:00 P.M.) to 4-15-75 (12:00 P.M.)

20 days shut in

Pulled pump and instruments 4-15-75

Set up limited data collection network in AT1-c, SG-6, SG-10, and SG-11 5-7-75 through 5-14-75 changed upper strings to Stevens digital recorders, lower and middle strings using pressure monitor on Sperry systems.

Manual plots and interpretation of the pressure responses in the lower aquifer, however, have yielded transmissivity values as shown in Table II B-38. More complete permeability values are being calculated.

With respect to potential aquifer interconnection, it was observed that pressure gauges in the upper zone showed no response to the pumping in the lower zone, in spite of large drawdown of lower aquifer water levels during the pumping of AT-1. Water levels in the upper aquifer continued to recover throughout the lower zone test. This is an expected response, if the two aquifer systems are hydraulically separated by the Mahogany zone; water levels in the upper zone would be expected to recover or rise as a response to the termination of pumping of the upper aquifer.

Alluvial Well Pump Test

As part of the baseline groundwater sampling of alluvial wells on Tract C-b, short term pumping tests (low volume rates), were conducted on two alluvial wells. Water samples were collected for analysis at the close of pumping. Water level data from the short term pumping tests were analyzed by standard graphical methods described in Summary Report #1. Transmissivity values for location A-1 was 10,082 gpd/ft. and for A-2 was 2,688 gpd/ft. This is typical for alluvial material and indicates that the alluvial deposits have high permeability and potential short term yields.

II B-10 Lithologic Log Data

Final lithologic logs for wells AT-1a, SG-1, SG-6, SG-8 through SG-11, SG-17, SG-18, and SG-19 are presented in Quarterly Report #3.

II B-11 Geophysical Log Data

The geophysical logs submitted in Quarterly Report #3 essentially complete the package of logs on the vertical holes drilled to date. Logs from the inclined hole drilling are not yet available, and it is possible that some future vertical drilling in preparation for the sinking of mine shafts may produce additional geophysical logs. As discussed in previous quarterly reports, the logging program includes several types of logs not specifically required by the Lessor. Specifically the cement bond log, perforation information logs and collar log provide information related to well completion. The purpose and description of the other types of logs used can be found in previous quarterly reports. (See Table II B-39).

II B-12 Core Assay Data

All assays of cores for oil, sodium, and alumina have been completed. Final reports are made in Quarterly Report #3. Summary Report #1 and Summary Report #2 carry descriptions of assay methodology and thus it will not be repeated here. Table II B-40 lists core assay data by the quarterly report in which it will be found.

(Text Continued on Page 80)

TABLE II B-38

LOWER AQUIFER PUMP TEST
TRANSMISSIVITY AND STORAGE COEFFICIENT VALUES

	Pulse Test - Initial Phase 3-10-75 to 3-18-75		Pulse Test - Drawdown Phase 3-18-75 to 3-26-75		
Well No.	Initial Drawdown	Initial Recovery	DRAWDOWN COMPUTATIONS	Horizontal Permeability	Final Recovery
AT #1	T = 310 g/d/ft. Initial T = 460 Secondary T = 380 Tertiary	T = 160 g/d/ft. Initial T = 320 Secondary	T = 359 gpd/ft. early stage T = 532 gpd/ft. Middle stage T = 756 gpd/ft. final stage	153.5 millidarcys	T = 194.7 gpd/ft Initial T = 351.0 gpd/ft. Final
AT #1A (String #1)	T = 441; S = 3.11x10-4 T = 338; S = 4.56x10-4	T = 435; S = 5.64x10-4 T = 335; S = 8.11x10-4	T = 465; S = 5x10-4	94.4 millidarcys	T = 333.4 gpd/ft.; S = 6.4x10^{-4} Initial T = 365.4 gpd/ft.; S = 5.3x10^{-4} Final
AT #1A (String #2)	No Usable Response	No Usable Response			No Usable Response
AT-1B	NO RESPONSE -- ONLY SHALLOW AQUIFER FUNCTIONING				
AT #1C (String #1)	T = 129; S = 1.52x10-4 T = 260; S = 2.24x10-5	T = 1125; S = 1.80x10-4 T = 255; S = 3.22x10-5	T = 219; S = 5x10-5 early stage Instrument drift during final stage		T = 133.4 gpd/ft.; S = 1.8x10^{-4} Initial T = 310.3 gpd/ft.; S = 1.5x10^{-5} Final
(String #2)	T = 173; S = 5.82x10-5 T = 275; S = 2.04x10-5 T = 376; S = 3.77x10-6	T = 157; S = 9.44x10-5 T = 340; S = 1.98x10-5	T = 316; S = 2x10-5 early stage T = 513; S = 6x10-7 final stage	104.2 millidarcys	T = 226 gpd/ft.; S = 5.2x10^{-5} Initial T = 346.9 gpd/ft.; S = 1.4x10-5 Final
AT #1D (String #1)	T = 143; S = 1.08x10-4 T = 348; S - 8.63x10-6	T = 136; S = 1.18x10-4 T = 325; S = 2.14x10-5	T = 271; S = 3x10-5 early stage T = 327; S = 7x10-7 final stage	66.4 millidarcys	T = 303.2 gpd/ft.; S = 2.5x10^{-5} Initial T = 360.5 gpd/ft.; S = 1.1x10^{-5} Final
SG - 6 (String #1)	T =1430; S = 4.52x10-4 T = 620; S = 3.87x10-4	T = 2800; S = 7.38x10-4	Slight downward response		T = 380.8 gpd/ft.; S = 1.02x10^{-3}
(String #2)	T =1520; S = 6.86x10-5 T = 574; S = 5.62x10-5 T = 305; S = 6.66x10-5	T = 400; S = 7.53x10-5	T = 442; S = 8x10-5 final stage	89.7 millidarcys	T = 400.5 gpd/ft.; S = 8x10^{-5}
SG - 10 (String #1)	T = 490; S = 6.06x10-5	T = 950; S = 1.13x10-4 T = 846; S = 1.11x10-4	T =1468; S = 2x10-4 T = 811; S = 1x10-4	164.6 millidarcys	T = 694.6 gpd/ft.; S = 1.4x10^{-5}
(String #2)	No Response	Very Slight Downward Response	No response		No Response
SG - 11 (String #1)	No Response	No Response	No response		No Usable Response
(String #2)	T =1065; S = 1.69x10-3	No Recovery-Downward Response	Overall downward trend		No Usable Response

TABLE II B-39

GEOPHYSICAL LOGS IN QUARTERLY REPORT #3*

	AT-1b	AT-1c	AT-1d	Cb-1	Cb-2	Cb-4	SG-1	SG-1a	SG-6	SG-9	SG-11	SG-17
Cement Bond Log	X	X	X	X	X	X	X			X	X	X
Perf. Record & Collar Log	X	X	X	X		X	X		X		X	X
Perf. Depth Log				X			X			X		X
Open Hole Amplitude & Volume								X				
Borehole Compensated Sonic		X						X	X			
Laterolog		X						X	X			
Neutron Formation Density		X						X	X			
Temperature		X						X	X			

*See well summary table II B-1 for additional detail on and location of all geophysical logs.

TABLE II B-40

Reported Core Assay Data

	Oil	Sodium	Alumina
AT-1a	1	1	1
SG-1	3	3	3
SG-6	3	3	3
SG-8	3	3	3
SG-9	2	2	2
SG-10	1	1	1
SG-11	3	3	3
SG-17	3	3	3
SG-18	1 Revised 3	3	3
SG-19	1	3	3
SG-20	3	3	3
SG-21	3	3	3

Numbers Refer to Quarterly Report in Which Assay Was Reported

II B-13 Core and Cuttings - Trace Element Analysis

In the following pages, trace element analyses required by the Lessor are presented in histogram form for coreholes AT-1a1, SG-8, SG-9 and SG-10. These elements are antimony (Sb), arsenic (As), boron (B), cadmium (Cd), fluorine (F), mercury (Hg), and selenium (Se). Very little data have been published covering trace elements in the study area. Fore the most part, it is not known how these elements are tied up in the rock and thus, their reaction as the rock weathers is unknown. However, research performed by the United States Geological Survey suggests that the high carbonate content of the oil shale host rock will help tie up the trace elements as the rock oxidizes. Because the elements discussed herein do not occur in significant amounts in the surface waters of the basin, it is assumed that their release to the environment through weathering is insignificant.

Selenium shows two maxima; one at a depth of about 500 feet, and the other at a depth of 800 feet in the SG-9. These two zones correlate into SG-8, but are not present in AT-1a1. Moderately high values of selenium occur in the mine zone in SG-10 and in other scattered zones below this point. There appears to be no reason for its distribution as neither SG-9 or SG-8 show similar build-ups. Selenium levels are usually less than 0.2 milligrams/liter in the groundwater system. This is well below Public Health standards.

Fluoride seems to gradually increase from the ground surface down to the mine zone, then more or less level off below that point. Fluorine is normally tied up in the minerals cryolite and fluorite. Fluoride is normally found in the subsurface waters and may reach concentrations of as much as 45 mg/l in some of the highly saline waters. Normally, it seldom exceeds 20 mg/l throughout the remainder of the section.

Arsenic, again, like fluorine gradually increase with depth approaching a near maximum concentration in the Mahogany mine zone. There is a very good correlation between the richness of the oil shale and the arsenic content. Arsenic levels in the groundwater system are usually less than 0.1 milligrams/liter (which is well below the Public Health standards); therefore, it appears to be chemically bonded with the kerogen and is not soluble in the ground water.

Antimony appears to be slightly higher in the mine zone than elsewhere. There is also a fair correlation between the richness of the shale and antimony content; however, this correlation is not as strong as it is for arsenic.

Boron distribution shows no particular correlation with depth, richness or stratigraphic zone. This is unusual as the marlstones contain one of the most unusual sites of boro-silicate minerals found anywhere. Boron levels are usually less than 3.0 milligrams/liter in the groundwater system

(Text Continued on Page 88)

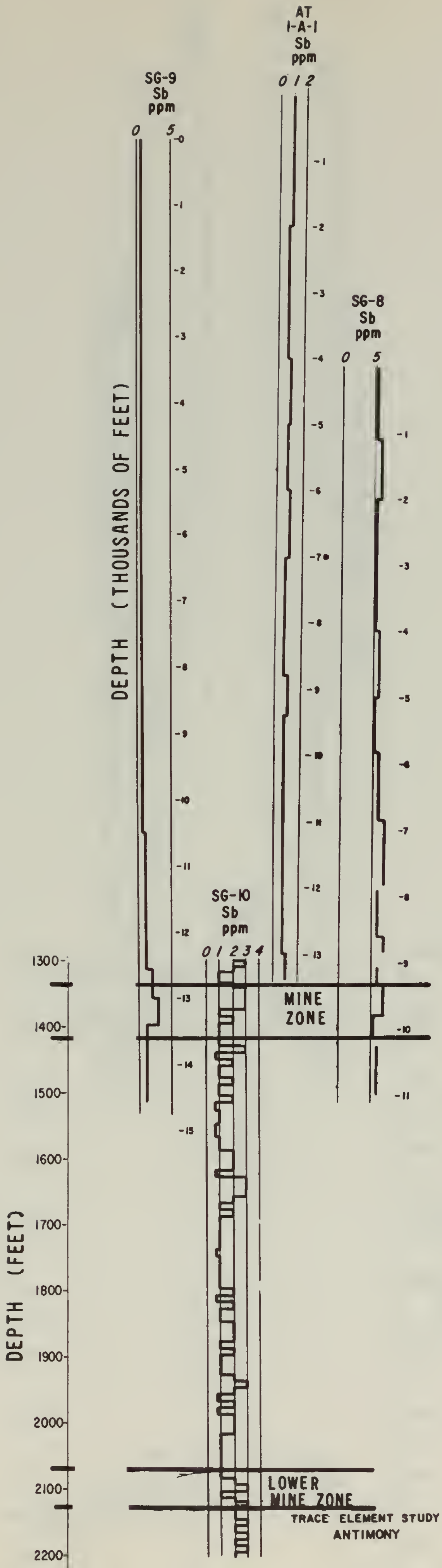


FIGURE II B-11
TRACE ELEMENT STUDY
ANTIMONY HISTOGRAM

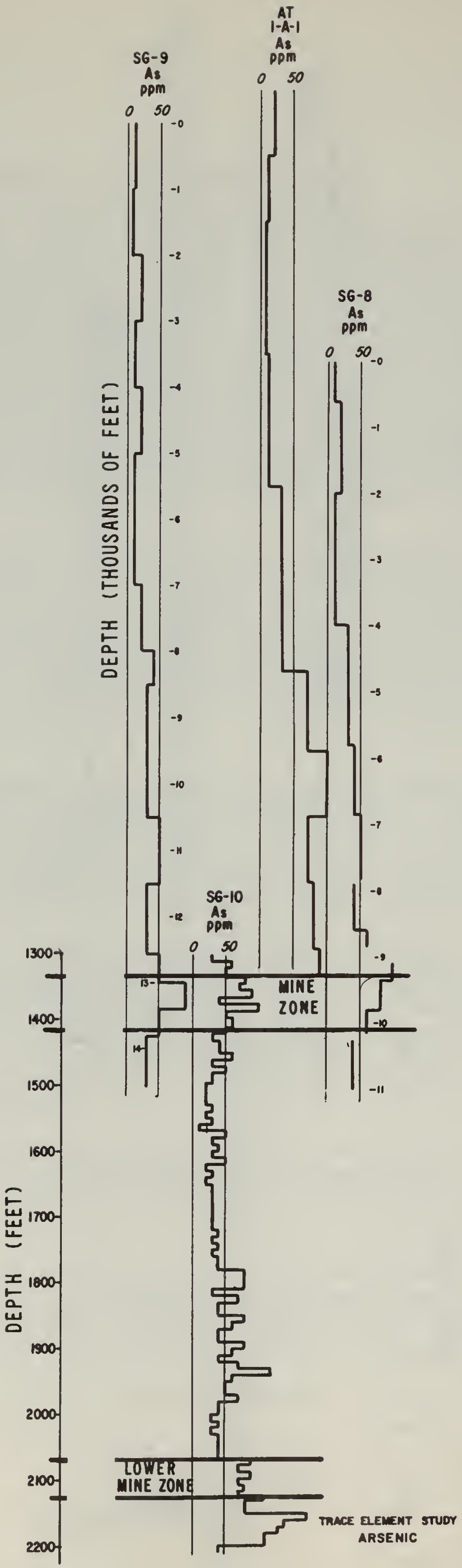


FIGURE II B-12
TRACE ELEMENT STUDY
ARSENIC HISTOGRAM

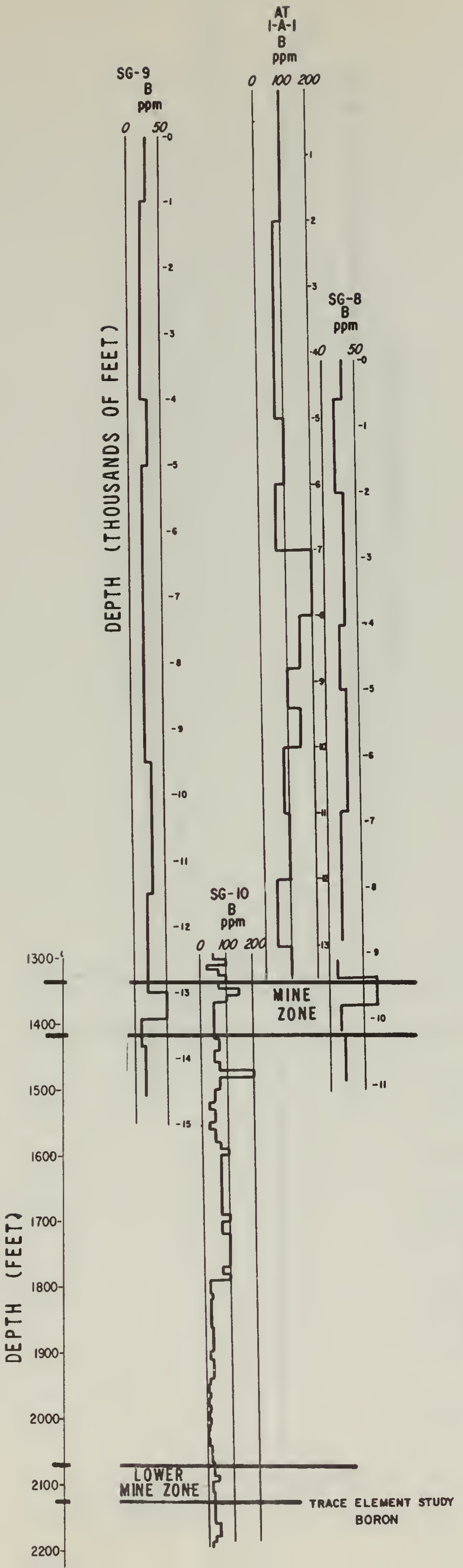


FIGURE II B-13
TRACE ELEMENT STUDY
BORON HISTOGRAM

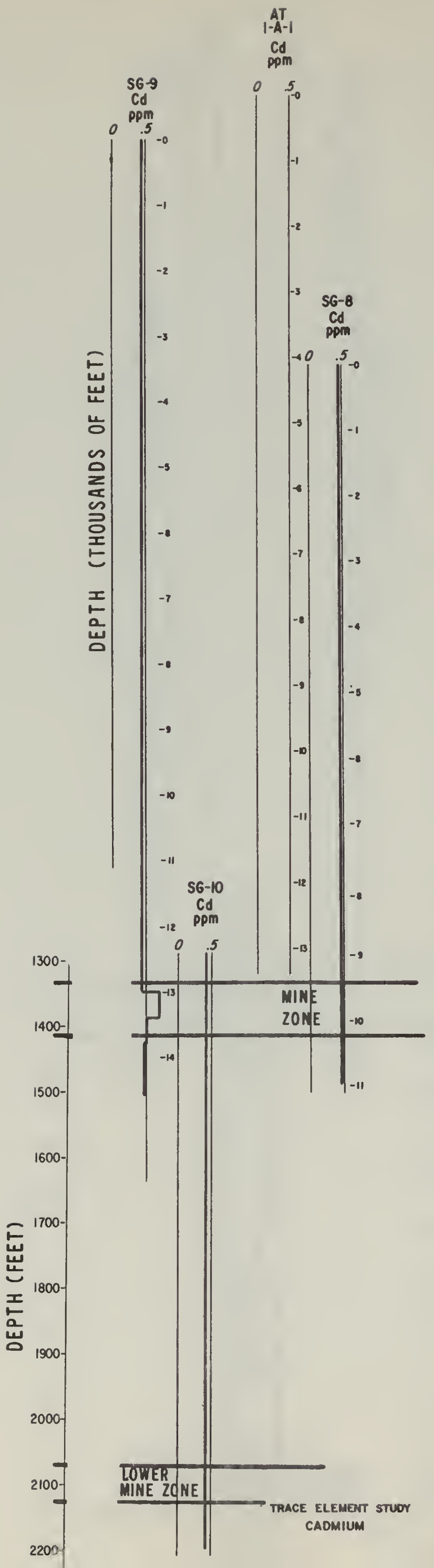


FIGURE II B-14
TRACE ELEMENT STUDY
CADMIUM HISTOGRAM

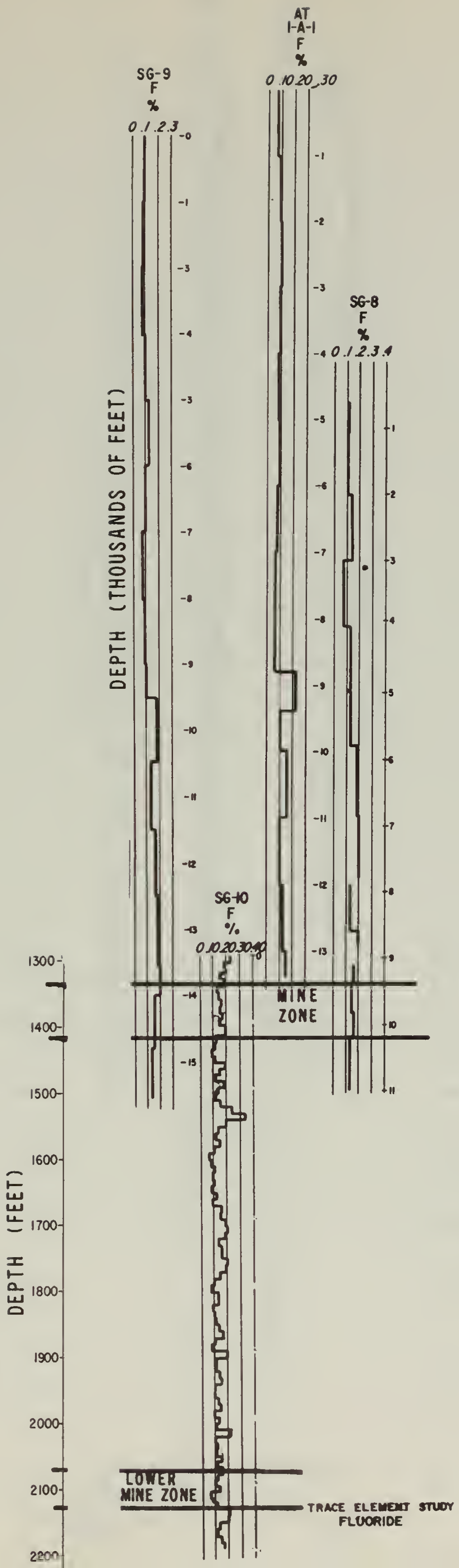


FIGURE II B-15
TRACE ELEMENT STUDY
FLUORIDE HISTOGRAM

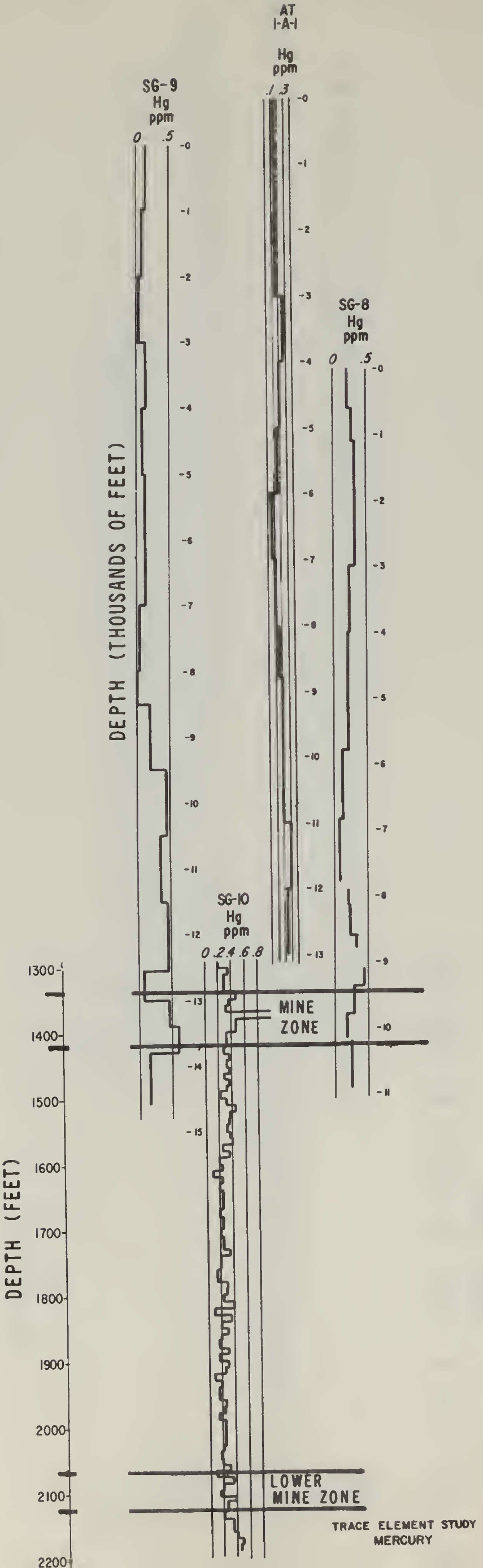


FIGURE II B-16
TRACE ELEMENT STUDY
MERCURY HISTOGRAM

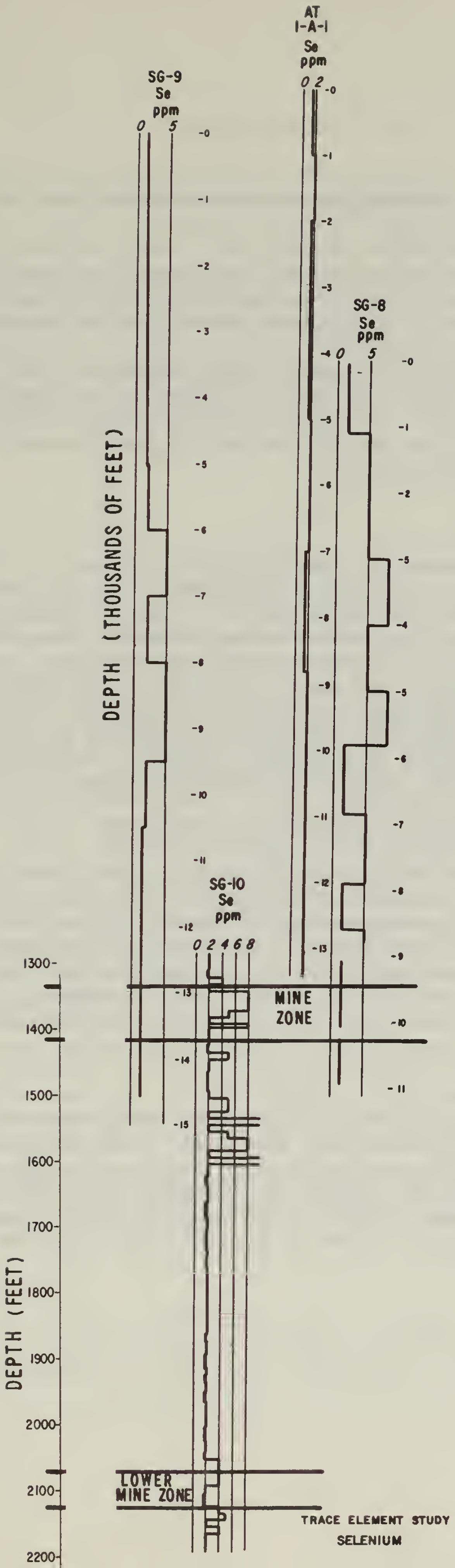


FIGURE II B-17
TRACE ELEMENT STUDY
SELENIUM HISTOGRAM

but can range as high as 47 milligrams/liter in some highly saline water zones.

Cadmium normally occurs below 0.5 ppm except through the mine zone on SG-9. This element is also found in the groundwater system, but below levels of 0.01 milligrams/liter which is well below Public Health standards.

Mercury levels are normally less than 0.5 ppm except for the mine zone in SG-9 and SG-10. There seems to be no correlation between depth or shale richness and mercury content. It appears mercury is not mobile in the ground water system since the mercury content of ground water under Tract C-b is below 0.001 milligrams/liter.

II B-14 Rock Mechanics

The results of the rock mechanics laboratory tests from all core material from the C-b Tract except that from AT-1a and SG-10 are presented in Quarterly Report #3. Data from AT-1a and SG-10 were included in Quarterly Report #1. Tests performed include uniaxial compressive strength, density, Brazilian tensile strength, direct shear, double shear, triaxial compressive strength and elastic modulus determination. Relationships of the various parameters are being evaluated by statistical correlation. The most promising correlations appear to be those relating density and grade and density with elastic modulus. When this work is completed, the data will be utilized in preliminary mine design.

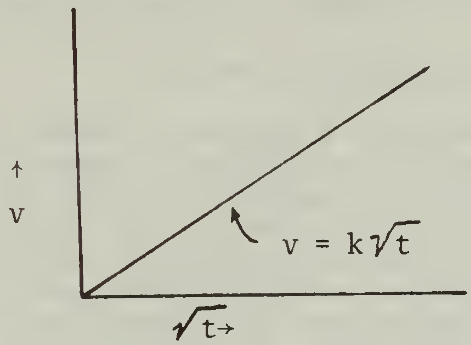
II B-15 Gas Samples - Tract C-b Gas Sampling Program

The basic purpose of the C-b gas sampling program is to obtain enough information concerning the occurrence of methane or other gases so that this information can be used in determining the mineability of the Tract. The conditions of approval for Tract C-b address this problem with a requirement for obtaining and analyzing two gas samples from each drillhole that penetrates the Mahogany or R-4 zones. The gas sampling program becomes one of gathering those data that will allow engineers to make estimates of volumes and of composition of gases found in the strata near the Mahogany oil shale zone.

Because the program is a new one and techniques and procedures for gathering samples from varying lithologies, particularly oil shale, have not been standardized. As discussed in Quarterly Report #1, the original plan using continuous gas sampling (Baroid Gas Chromatograph) was modified after drilling the first corehole (SG-10). Grab-sampling in pressure bombs was added as a supplementary system to the continuous sampling instruments.

Sampling From Cores

To analyze the cores recovered in this program for gas content, an analytical procedure was adapted from coal technology[1]. This procedure, known as the "Direct Method," actually measures the volume of gas emitted from a core of rock material (coal), and then by extrapolating backward and summing the emissions over time to $t = 0$, when the rock material was cored, the in-place gas volume can be estimated. This procedure is based on empirical evidence that the volume of gas emitted from coal is proportional to the square root of time, with time zero taken to be the instant emission began[2]. This relationship is expressed graphically as



To use this method in analyzing gas emissions from rock material other than coal, it is necessary to assume that this empirical equation holds true. To date this assumption appears to be correct for the cores from SG-17 obtained from below the mining zone in a stratum comprised mainly of marlstone, argilaceous marly shale laminated with oil shale, and some weathered dolomite, brecciated and fractured, with solution cavities throughout. Similar tests are being run on oil shale cores taken from the Mahogany zone and to date, no gas has been detected. Actual correlation or substantiation of analytical results, as can be obtained in coal mining operations, is not possible because there are no oil shale mines with similar underground conditions in operation in this region. Precise oil shale-mine gas emission rates will be known only after an underground mine has been put into operation. However, estimates adequate for planning purposes may be possible.

The analytical procedure for the "Direct Method" is initiated when the Baroid gas detection instrument indicates a presence of a measurable amount of gas for a specific footage, or when a request from the mining-engineering group is made. Once the core barrel reaches the surface, the core is removed and carefully examined for bleeding or bubbling gas. If a core length is gassy, or if a core test request is made, the core is sealed immediately in a "gassy core bomb." Records are kept of total volume of gas emitted while in the bomb. When gas emission ceases, the evolved gas is collected for analysis and the core returned to its proper place in the core rack. Gas emission rate data are used to estimate the in-place gas volumes and Figure II B-18 is a typical plot of cumulative volume versus time for the "Direct Method" volumetric determination. Corehole SG-17 was the first corehole on which these analyses were attempted. No gas emissions were recorded from the Mahogany mining zone. Gas data from almost 200 feet below the mining zone are summarized in Table II B-41. At the present time, this methodology is being applied on oil shale cores from the Mahogany zone in the NQ slant hole coring program. Figure II B-19 is a schematic of the gas collection system.

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[1] Kissell, F. N., C. M. McCulloch, and C. H. Elder. The Direct Method of Determining Methane Content of Coalbeds for Ventilation Design. U. S. Bureau of Mines, Report of Investigation 7767, 1973, 17 pp.

[2] Sevenster, P. G. Diffusion of Gases through Coal. Fuel. V. 38, 1959, p. 403.

Production Sampling From SG-11

In addition to the "Direct Method," a program to obtain actual production rates and formation pressures was established. Inasmuch as the completion of observation string #1 in SG-11, located 800 to 900 feet below the potential mining zone, encountered a flow of water with a slight amount of gas, this well was chosen for the first production sampling. Because of potential interference with other testing programs, potential freeze problems during the winter and concern for producing water in excess of that allowed by discharge regulations, only SG-11 has been tested. Additional flow tests are planned.

To monitor the amount of flow and collect samples for analysis a gas-water seaprator and flow meter were installed at SG-11. Figure II B-20 shows gas production which exhibits numerous peaks and valleys over a 21-day period. Based on observation of the actual well behavior these probably constitute a "heading" phenomenon. That is, the hydrostatic head of the water retards gas release until the gas pressure buildup is sufficient to overcome the hydrostatic pressure. Then gas is produced until the overriding gas pressure is reduced below hydrostatic. This same phenomenon is not uncommon in gas-saturated oil wells and has been observed in "cold water" geysers in eastern Utah and water wells in southwestern Colorado. This effect implies low formation permeability or poor communication between formation and the well bore.

Aquifer Test Data

A gas-water separator was installed in the flow line of Aquifer Test Well AT-1 during the upper aquifer pump tests. The water and gas produced were monitored for the duration of the test. Gas was in solution in the water and was produced as the water was produced. It is important to note that at the temperature and pressure prevailing in the upper aquifer, the groundwater is capable of containing in solution approximately 100 times the quantity of gas that was produced for the same amount of water. So, in effect only soluble gas was produced. The gas-water ratio was very low, measuring one cubic foot of gas to 315 gallons of water. Laboratory analysis of the gas produced gave an average 48.91 mole-percent methane, 3050 volumetric parts per million ethane, and the balance air (Table II B-42). Similar data for the lower aquifer pump test have been gathered but not yet reduced and analyzed.

FIGURE II B-18

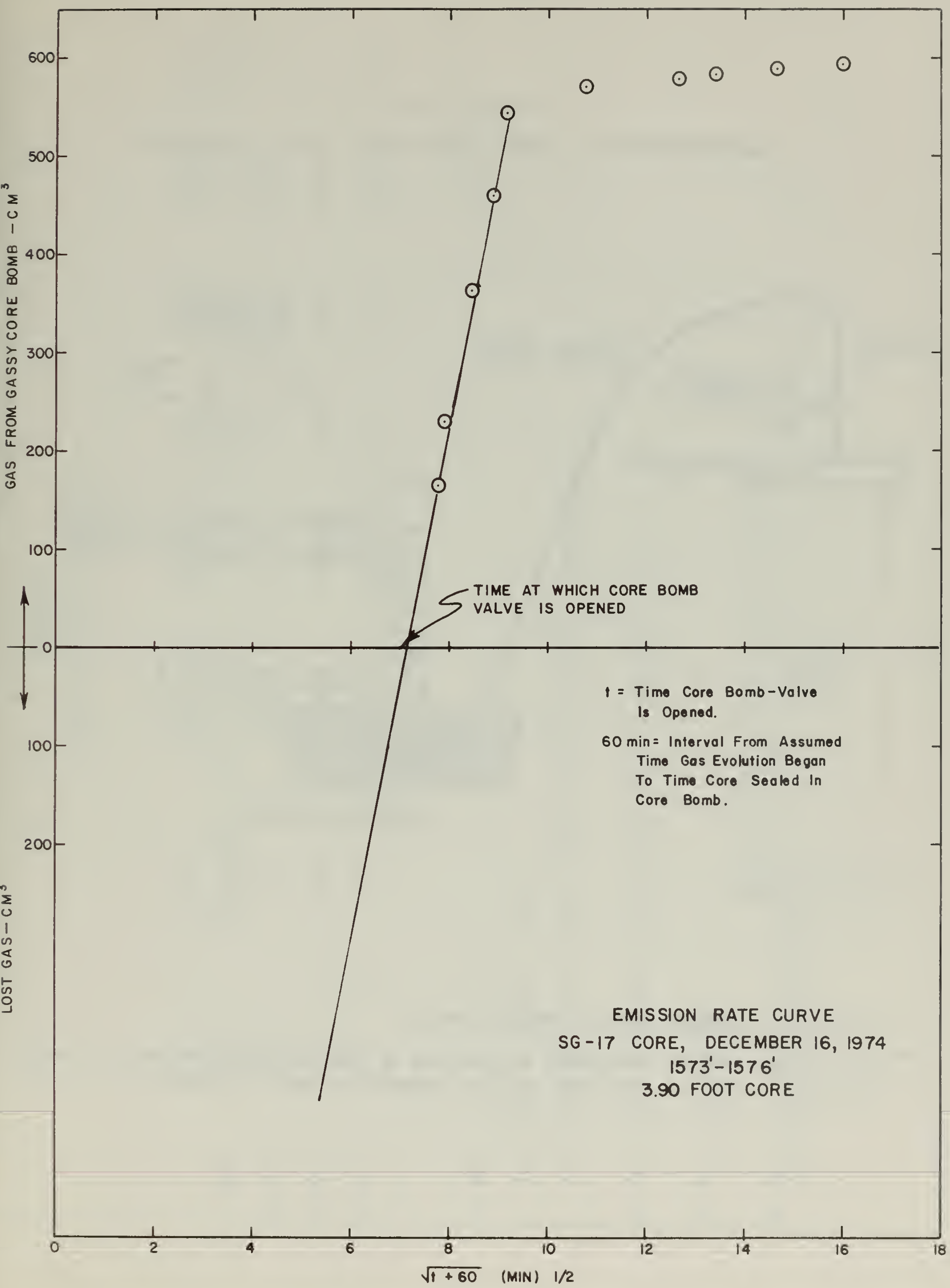
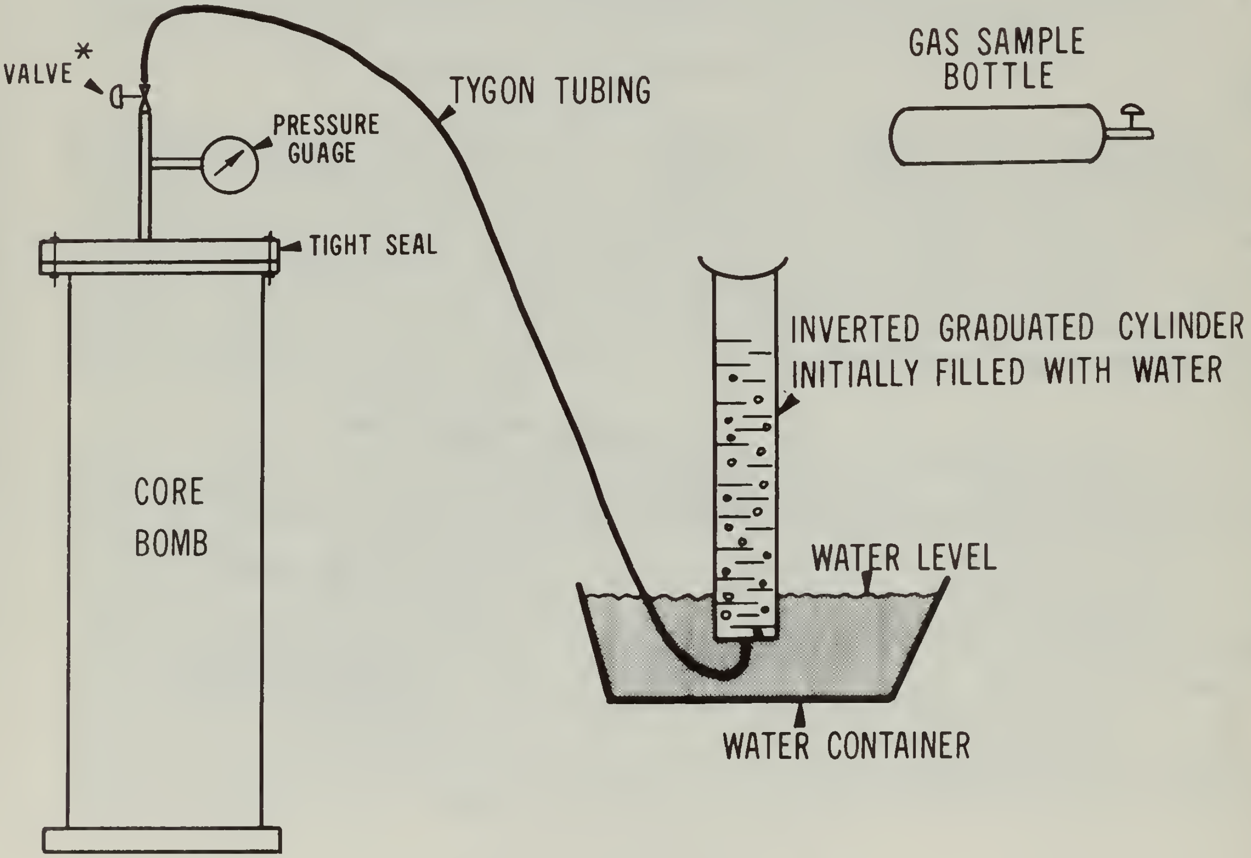


FIGURE II B-19

SCHEMATIC GAS COLLECTION SYSTEM



GAS EMISSION IS MEASURED BY DISPLACEMENT OF WATER

*INITIALLY VALVE IS CLOSED. THEN OPENED TO ALLOW GAS TO FLOW TO INVERTED GRADUATED CYLINDER. THEN CLOSED TO STOP GAS FLOW WHEN REFILLING GRADUATED CYLINDER WITH WATER.

TABLE 41
SG-17
SUMMARY OF GASSY CORE DATA

Date	Depth(1) ft.	Slope(3) $cm^3/(min)^{\frac{1}{2}}$	θ Value When No Gas Evolved t = 0	Gas(2) Lost cm^3	Gas Evolved cm^3	Total Gas cm^3	Weight Core(4) 9	Core Gas $cm^3/9$
12/13/74	1573-76	236	7.10	1676	594	2270	16005	0.14
12/16/74	1671-74	180	9.110	1640	187	1927	16374	0.12
12/16/74	1692.6-95.9	23	8.544	197	13	210	15165	0.01

(1) Mine floor: 1399 ft.

Top lower rich zone = 1697 ft.

All gassy cores from lower aquifer - high pressure, low volume gas

(2) Gas "lost" = slope x θ value when no gas evolved (t = 0)

(3) From Figures 2-5.

(4) Approximation made from compensated formation density logs; more definitive data available later date.

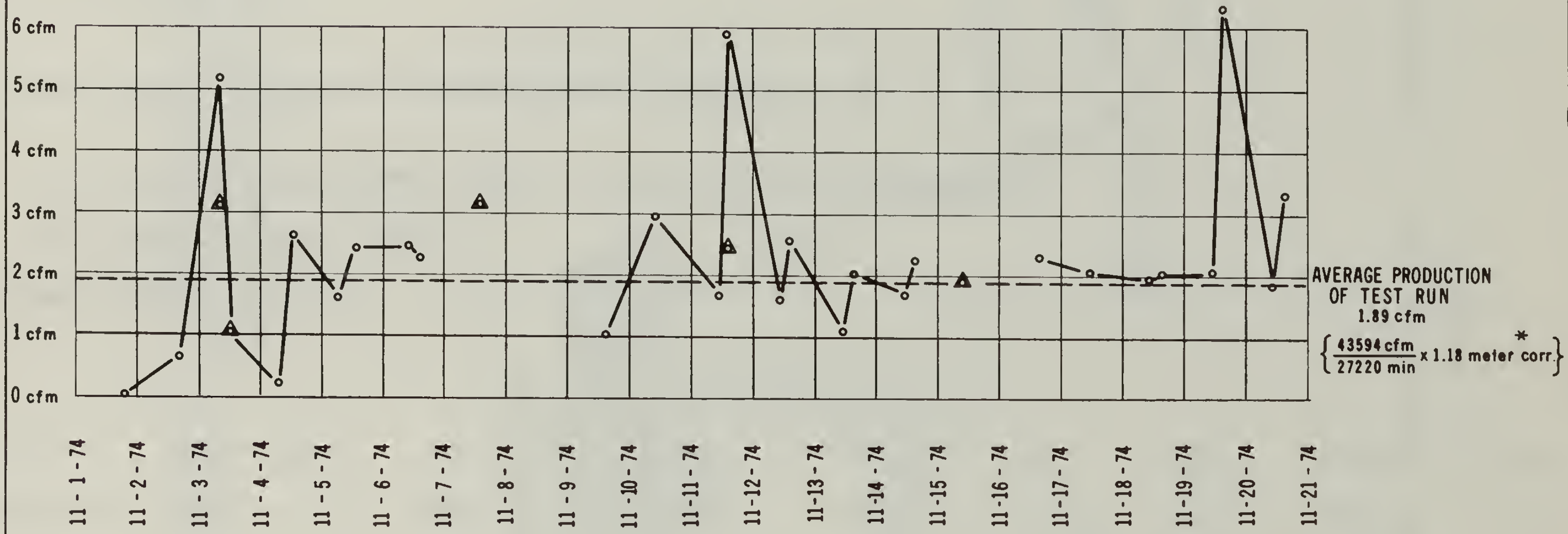


FIGURE II B-20

SORGHUM GULCH #11 FLOW TEST
GAS PRODUCTION RATE VERSUS TIME
NOVEMBER 1974

▲ DATA MODIFIED OWING TO ERROR IN READING METER

* METER CALIBRATION CORRECTION

TABLE II B-42

Gas Sample Analysis Upper Aquifer Test

Date		Methane Mole %	Ethane Vppm	Balance Air
12/5/74	1615 Hr.	44.38	3300	Air
12/7/74	1800 Hr.	53.44	2800	Air
Average		48.91	3050	Air

Grab Samples From Wells

Gas samples were collected for all coreholes drilled after the completion of corehole SG-10. Additional gas samples were collected during pumping tests, drillstem tests and jetting tests. Samples were collected in evacuated stainless steel or glass cylindrical containers and were analyzed for methane, ethane, heavier hydrocarbons, hydrogen, carbon monoxide, carbon dioxide and hydrogen sulfide by The Oil Shale Corporation's laboratory in Golden, Colorado. The samples were analyzed using gas chromatography with flame ionization and thermal conductivity detectors. The results of these analyses are given in Table II B-43. These data when combined with the data submitted in Quarterly Report #1 and #2 indicate that methane content is generally less than five mole-percent in gas samples collected during drilling operations. Samples collected from wells flowing gas or from pumped wells ranged between 15 and 80 mole percent methane. However, total gas volumes involved were low. Very small amounts of ethane were found--values ranging from 201 to 3300 volumetric parts per million.

Data will continue to be collected as the drilling and testing programs continue. Improvement in coverage will be obtained from the slant-hole drilling program, from analysis of the most recent pump tests and as techniques and methodologies improve.

TABLE II B-43
ANALYSIS OF GAS SAMPLES FROM TRACT C-b
January, 1975 - May, 1975 (1,2)

Core Hole	Description	Date	Depth (feet)	Methane (Mole %)	Ethane (Vppm)	Ethylene (Mole %)	CO_2 (Mole %)	Balance
SG-11	String No. 1 Bleed Off	3/11/75	-	71.28	1455	2.32	0.14	Air
SG-17		1/ 9/75	2405	3.33	-	-	-	Air
SG AT-1		1/28/75	-	1.05	-	-	-	Air
		2/16/75	-	72.12	200	0.39	-	Air
	2 pm	3/ 6/75	-	77.47	229	-	0.15	Air
	Lower Aquifer Drawdown 1500 hr.	3/ 9/75		78.43	100	-	0.15	Air
	Lower Aquifer Pulse Test	3/26/75		75.67	311	0.45	0.16	Air

[1] No H_2, CO, H_2S, or heavier hydrocarbons were found in any of the samples.

[2] Analysis of Gas Samples September - November, 1974 in Quarterly Report #1
Analysis of Gas Samples November, 1974 - January, 1975 in Quarterly Report #2

II C AIR QUALITY

The Tract C-b program is concerned with measurements of the atmospheric chemical constituents and the meteorological processes which affect their transport and diffusion. The scope of these programs is designed to satisfy the objectives of the environmental baseline data collection studies:

1) to establish the air quality and meteorological baseline;

2) to become an integral part in the long term monitoring program and to establish the basis for that program as well as to aid in determining its scope, objectives and design;

3) to provide inputs into an atmospheric diffusion model;

4) to provide data that will allow a valid assessment and prediction of any potential air quality impacts and establish a basis for mitigating these; and

5) to provide some environmentally-oriented criteria for oil shale plant design and location, e.g., peak wind speeds.

II C-1 Air Quality and Surface Meteorology

The third quarterly air quality data reports cover the months of January through April. Included as part of these data reports is Radian's quarterly data summary for December through February. In addition to the usual diurnal tables these data are also presented graphically, beginning with the January report. The diurnal ozone tables in the September through February reports were incorrectly reported in parts per billion, but can be corrected to ug/m^3 by multiplying those values by 1.95. Tables II C-1 through C-5 summarize the maximum concentrations for the gases and particulates from December through February that correspond to the appropriate time intervals as determined by State and Federal regulations. Table II C-6 is the frequency distribution by concentration per trailer for particulates and shows the geometric mean for the three months. Tables II C-7 through C-15 tabulate the maximum sliding one hour average. In the case of the non-methane hydrocarbons and the particulates, these maximums are for the 6:00 - 9:00 a.m. interval and 24 hour period, respectively. These are shown with the corresponding date, time of day, wind direction and speed.

The January through April data do not exhibit any well defined and predictable patterns for sulfur dioxide (SO_2) and hydrogen sulfide (H_2S). A close examination of the Radian monthly data reports will reveal some short-lived and inconsistent patterns on a diurnal basis for high values at a particular trailer location or perhaps with

(Text Continued on Page 114)

TABLE II C-1

QUARTERLY SUMMARY (Dec '74 - Feb '75)
(Concentrations in Micrograms per Cubic Meter)

TRAILER No. 020

Recorded Parameter	Average	Maximum 24-hr. Concentration		Maximum 8-hr. Concentration		Maximum 3-hr. Concentration		Maximum 1-hr. Concentration		Maximum 5-min. Concentration	
		Value	Time	Value	Time*	Value	Time*	Value	Time*	Value	Time*
SO_2	0.5	14.4	12/8 3:00			17.2	12/9 0:05	17.4	12/8 21:40	83.4	2/20 11:10
H_2S	.05							13.7	2/19 12:05	70.0	1/13 14:55
Particulates	3.7	17.0	1/18								
Total Hydrocarbons	952.9					1340.5	2/3 6:00			3232.1	12/24 2:00
CH_4	898.8					1298.0	2/3 6:00			3241.8	12/24 1:40
Non-CH_4 Hydrocarbons	66.5					228.3	1/12 6:00			2070.9	12/5 15:55
O_3	83.7							146.0	2/19 15:55	154.3	12/9 15:40
NO_x	7.0							44.0	1/22 7:30	84.0	1/30 3:25
NO	1.6							43.7	1/22 7:30	84.0	1/30 3:25
CO	969.5			1451.3	12/15 6:55			1853.7	12/15 13:30	5698.0	1/11 19:90
NO_2	5.3							36.0	12/3 17:10	56.2	12/9 23:00

1 - Geometric Mean, 2 - 30-Minute Averaging Time, *Start of interval of occurrence.

TABLE II C-2

QUARTERLY SUMMARY (Dec '74 - Feb '75)
(Concentrations in Micrograms per Cubic Meter)

TRAILER No. 021

Recorded Parameter	Average	Maximum 24-hr. Concentration		Maximum 8-hr. Concentration		Maximum 3-hr. Concentration		Maximum 1-hr. Concentration		Maximum 5-min. Concentration	
		Value	Time	Value	Time*	Value	Time*	Value	Time*	Value	Time*
SO_2	1.0	13.6	12/2 15:00			23.2	2/21 6:05	53.4	1/26 14:05	640.0	1/26 15:05
H_2S	.4							9.5	2/7 17:10	27.7	12/7 8:25
Particulates	4.5	18.0	12/10								
Total Hydrocarbons											
CH_4											
Non-CH_4 Hydrocarbons											
O_3											
NO_x											
NO											
CO											

1 - Geometric Mean, 2 - 30-Minute Averaging Time, *Start of time interval of occurrence.

TABLE II C-3

QUARTERLY SUMMARY (Dec '74 - Feb '75)
(Concentrations in Micrograms per Cubic Meter)

TRAILER No. 022

Recorded Parameter	Average	Maximum 24-hr. Concentration		Maximum 8-hr. Concentration		Maximum 3-hr. Concentration		Maximum 1-hr. Concentration		Maximum 5-min. Concentration	
		Value	Time	Value	Time*	Value	Time*	Value	Time*	Value	Time*
SO_2	0.1	2.9	12/19 20:00			20.4	12/20 0:05	20.8	12/20 1:15	140.7	2/22 9:45
H_2S	0.4							14.3	2/28 20:55	29.0	1/25 15:25
Particulates	3.3	116.0	12/1								
Total Hydrocarbons	☒										
CH_4	☒										
Non-CH_4 Hydrocarbons	☒										
O_3	☒										
NO_x	☒										
NO	☒										
CO	☒										

1 - Geometric Mean, 2 - 30-Minute Averaging Time, *Start of time interval of occurrence.

TABLE II C-4

QUARTERLY SUMMARY (Dec '74 - Feb '75)
(Concentrations in Micrograms per Cubic Meter)

TRAILER No. 023

Recorded Parameter	Average	Maximum 24-hr. Concentration		Maximum 8-hr. Concentration		Maximum 3-hr. Concentration		Maximum 1-hr. Concentration		Maximum 5-min. Concentration	
		Value	Time	Value	Time*	Value	Time*	Value	Time*	Value	Time*
SO_2	3.0	43.0	1/1 11:00			87.7	12/21 0:10	97.9	12/21 1:55	200.6	12/22 14:45
H_2S	2.8							28.4	1/1 11:10	91.3	12/22 14:35
Particulates	3.4	22.0	12/4								
Total Hydrocarbons	7358.9					34141.5	12/12 6:00			65123.0	12/8 14:00
CH_4	961.1					1925.3	12/29 6:00			3243.1	12/22 5:40
Non-CH_4 Hydrocarbons	6537.7					33269.7	12/2 6:00			64530.4	12/20 17:40
O_3	56.9							135.6	2/23 21:45	781.5	2/23 22:20
NO_x	11.0							121.9	1/16 1:20	256.0	1/1 2:20
NO	7.7							114.2	1/17 9:55	228.0	1/10 13:00
CO	1404.7			5035.2	12/19 3:55			5061.4	12/19 4:50	5640.1	12/6 14:00
NO_2	3.3							68.2	1/16 9:15	95.0	1/16 10:15

1 - Geometric Mean, 2 - 30-Minute Averaging Time, *Start of interval of occurrence.

TABLE II C-5

QUARTERLY SUMMARY (Dec '74 - Feb '75)
(Concentrations in Micrograms per Cubic Meter)

TRAILER No. 024

Recorded Parameter	Average	Maximum 24-hr. Concentration		Maximum 8-hr. Concentration		Maximum 3-hr. Concentration		Maximum 1-hr. Concentration		Maximum 5-min. Concentration	
		Value	Time	Value	Time*	Value	Time*	Value	Time*	Value	Time*
SO_2	2.9	25.4	2/5 17:00			77.9	12/10 6:05	128.5	12/10 6:20	161.5	12/10 7:10
H_2S	0.1							27.6	1/10 16:45	33.0	1/10 17:30
Particulates	2.8	16.0	1/27								
Total Hydrocarbons	╳										
CH_4	╳										
Non-CH_4 Hydrocarbons	╳										
O_3	╳										
NO_x	╳										
NO	╳										
CO	╳										

1 - Geometric Mean, 2 - 30-Minute Averaging Time, *Start of time interval of occurrence.

TABLE II C-6

PARTICULATES
C-b SHALE OIL MONITORING PROJECT
DECEMBER 1974 - FEBRUARY 1975

SITE	020	021	022	023	024
CONCENTRATION					
µg/m³					
>260					
240-260					
220-240					
200-220					
180-200					
160-180					
140-160					
120-140					
100-120			1		
80-100			0		
60- 80			0		
40- 60			0		
20- 40			0	1	
<20	61	62	66	47	58
TOTAL	61	62	67	48	58
GEOMETRIC MEAN	3.7	4.5	3.3	3.4	2.8

SO_2
Constituent

TABLE II C-7

1 - HOUR MAXIMUM CONCENTRATIONS

By Month

Trailer	Item	(1) Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
020	Value (ug/m^3)	64.7	4.6	17.4	2.6	7.6	32.8	7.2					
	Date	10/7	11/1	12/8	1/14	2/20	3/7	4/12					
	Time (MST)	16:15	13:50	21:48	16:10	10:55	10:05	11:35					
	Wind Direction (Deg.)	279	204	102	134	275	190	266					
	Wind Speed (MPH)	3	5	1	5	12	8	3					
023	Value (ug/m^3)	48.6	0.2	97.9	50.6	5.0	12.2	8.2					
	Date	10/2	11/1	12/21	1/1	2/20	3/29	4/5					
	Time (MST)	18:40	11:15	1:55	14:30	11:30	22:05	10:05					
	Wind Direction (Deg.)	205	191	156	358	236	201	184					
	Wind Speed (MPH)	7	8	7	4	18	3	18					
021	Value (ug/m^3)	269.6	32.8	25.8	53.4	23.2	21.3	21.7					
	Date	10/7	11/1	12/19	1/26	2/21	3/25	4/25					
	Time (MST)	13:00	1:35	15:45	14:05	5:00	9:00	20:25					
	Wind Direction (Deg.)	137	128	324	176	156	154	288					
	Wind Speed (MPH)	4	5	7	10	5	8	11					
022	Value (ug/m3)	11.7	13.0	20.8	5.9	11.7	14.1	2.6					
	Date	10/1	11/6	12/20	1/25	2/22	3/3	4/17					
	Time (MST)	13:30	17:00	1:15	14:25	8:45	8:30	3:30					
	Wind Direction (Deg.)	274	120	127	275	107	110	291					
	Wind Speed (MPH)	6	1	6	9	2	5	5					
024	Value (ug/m^3)	14.8	5.2	128.5	54.3	34.3	50.8	49.1					
	Date	10/23	11/29	12/10	1/5	2/26	3/3	4/13					
	Time (MST)	3:50	21.10	6:20	11:50	2:25	22:50	17:35					
	Wind Direction (Deg.)	-	80	12	178	63	60	284					
	Wind Speed (MPH)	-	3	0	9	0	3	5					

(1) 30-Minute Averages

H_2S
Constituent

TABLE II C-8

1 - HOUR MAXIMUM CONCENTRATIONS

By Month

Trailer	Item	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
020	Value (ug/m^3)	3.3	10.1	2.2	6.2	13.7	12.5	2.2					
	Date	10/21	11/9	12/8	1/13	2/19	3/7	4/2					
	Time (MST)	11:55	20:00	7:10	14:05	12:35	10:05	13:30					
	Wind Direction (Deg.)	157	111	104	174	186	190	208					
	Wind Speed (MPH)	9	0	1	1	7	8	5					
023	Value (ug/m^3)	145.3	3.2	45.3	28.4	8.2	19.1	6.5					
	Date	10/31	11/12	12/21	1/1	2/26	3/7	4/14					
	Time (MST)	19:05	5:40	1:55	11:10	6:05	18:55	6:55					
	Wind Direction (Deg.)	230	123	156	315	156	165	113					
	Wind Speed (MPH)	-	4	7	4	2	7	5					
021	Value (ug/m^3)	130.9	58.9	4.6	4.7	9.5	7.3	4.3					
	Date	10/28	11/18	12/7	1/31	2/7	3/21	4/26					
	Time (MST)	20:00	1:25	8:00	4:35	17:10	21:30	23:20					
	Wind Direction (Deg.)	142	123	337	138	163	117	350					
	Wind Speed (MPH)	0	0	2	5	12	6	3					
022	Value (ug/m3)	14.1	4.7	8.4	2.4	14.3	14.1	10.1					
	Date	10/1	11/18	12/8	1/25	2/28	3/1	4/11					
	Time (MST)	3:30	9:35	0:40	14:25	20:55	0:00	14:00					
	Wind Direction (Deg.)	91	126	69	275	72	102	34					
	Wind Speed (MPH)	12	10	8.5	9	2	5	5					
024	Value (ug/m^3)		8.3	7.7	27.6	8.1	8.5	62.5					
	Date		11/5	12/24	1/10	2/17	3/23	4/14					
	Time (MST)		15:55	1:55	16:45	13:10	2:40	0:35					
	Wind Direction (Deg.)		268	154	201	258	89	197					
	Wind Speed (MPH)		3	1	2	9	2	6					

Particulate
Constituent

TABLE II C-9

24 - HOUR MAXIMUM CONCENTRATIONS

By Month

Midnight - Midnight

Trailer	Item	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
020	Value (ug/m^3)	17.0	133.0	11.0	17.0	11.0	39.0	89.0					
	Date	10/20	11/29	12/12	1/18	2/27	3/22	4/25					
	(1)24-hr ave. Wind Direction(Deg)	128	121	107	117	124	195	170					
	Max. 1-hr ave. Wind Speed	7	5	8	8	5	14	24					
	Wind Speed - 24-hr ave.	3	2	3	5	4	7	15					
023	Value (ug/m^3)	36.0	26.0	22.0	6.0	11.0	171.0	112.0					
	Date	10/19	11/27	12/4	1/11	2/27	3/22	4/25					
	(1)24-hr ave. Wind Direction	207	174	171	313	192	226	186					
	Max. 1-hr ave. Wind Speed	8	15	18	16	5	38	41					
	Wind Speed - 24-hr ave.	4	7	10	8	4	16	27					
021	Value (ug/m^3)	20.0	71.0	18.0	7.0	10.0	32.0	125.0					
	Date	10/18	11/21	12/10	1/13	2/28	3/22	4/25					
	(1)24-hr ave. Wind Direction	145	114	102	4	140	170	168					
	Max. 1-hr ave. Wind Speed	-	10	9	6	8	20	28					
	Wind Speed - 24-hr ave.	-	4	4	3	4	9	14					
022	Value (ug/m^3)	2.0	154.0	116.0	10.0	12.0	44.0	82.0					
	Date	10/31	11/28	12/1	1/26	2/12	3/21	4/25					
	(1)24-hr ave. Wind Direction	86	290	137	112	116	168	136					
	Max. 1-hr ave. Wind Speed	5	9	9?	12	12	9	16					
	Wind Speed - 24-hr ave.	3	5	5	5	7	5	13					
024	Value (ug/m^3)	1.0	178.0	8.0	16.0	9.0	27.0	80.0					
	Date	10/31	11/27	12/5	1/27	2/28	3/22	4/25					
	(1)24-hr ave. Wind Direction	-	118	261	248	130	196	180					
	Max. 1-hr ave. Wind Speed	-	8	7	5	8	33	37					
	Wind Speed - 24-hr ave.	-	4	2	3	4	13	22					

(1) Vector Averages

Non-Methane HC
Constituent

TABLE II C-10

3 - HOUR MAXIMUM CONCENTRATIONS
(6-9 am)

By Month

Trailer	Item	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
020	Value (ug/m^3)	88.7	197.6	179.7	223.8	51.4	288.6	707.7					
	Date	10/29	11/25	12/19	1/12	2/25	3/31	4/22					
	Time (MST)	6-9A.M.	6-9A.M.	6-9A.M.	6-9A.M.	6-9A.M.	6-9A.M.	6-9AM					
	Wind Direction (Deg.)	332	127	101	117	107	128	130					
	Wind Speed (MPH)	0	11	1	7	4	3	6					
023	Value (ug/m^3)	9705.3*	17151.9*	33269.7*	2316*	18.1	34.2	302.2					
	Date	10/29	11/23	12/12	1/4	2/28	3/31	4/21					
	Time (MST)	6-9A.M.	6-9A.M.	6-9A.M.	6-9A.M.	6-9A.M.	6-9A.M.	6-9AM					
	Wind Direction (Deg.)	207	28	179	116	182	194	139?					
	Wind Speed (MPH)	-	3	6	6	7	15	1					
021	Value (ug/m^3)												
	Date												
	Time (MST)												
	Wind Direction (Deg.)												
	Wind Speed (MPH)												
022	Value (ug/m^3)												
	Date												
	Time (MST)												
	Wind Direction (Deg.)												
	Wind Speed (MPH)												
024	Value (ug/m^3)												
	Date												
	Time (MST)												
	Wind Direction (Deg.)												
	Wind Speed (MPH)												

*Contaminated Manifold

Methane Hc
Constituent

TABLE II C-11

3 - HOUR MAXIMUM CONCENTRATIONS
(6-9 am)

By Month

1974

Trailer	Item	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
020	Value (ug/m^3)	792.7	933.2	1219.5	999.2	1298.0	998.8	837.8					
	Date	10/29	11/9	12/8	1/12	2/3	3/15	4/28					
	Time (MST)							6-9AM					
	Wind Direction (Deg.)	330	77	111	118	278	~317	124					
	Wind Speed (MPH)	0	0	2	6	3	-	2					
023	Value (ug/m^3)	13989.8*	96.7	1925.3	1137.7	900.1	910.2	902.4					
	Date	10/1	11/7	12/29	1/1	2/15	3/3	4/18					
	Time (MST)							6-9AM					
	Wind Direction @ 30'	92	98	151	144	306	159	228					
	Wind Speed @ 30'	1	4	3	4	9	0	9					
021	Value (ug/m^3)												
	Date												
	Time (MST)												
	Wind Direction (Deg.)												
	Wind Speed (MPH)												
022	Value (ug/m^3)												
	Date												
	Time (MST)												
	Wind Direction (Deg.)												
	Wind Speed (MPH)												
024	Value (ug/m^3)												
	Date												
	Time (MST)												
	Wind Direction (Deg.)												
	Wind Speed (MPH)												

*contaminated manifold

CO
Constituent

TABLE II C-12

1 - HOUR MAXIMUM CONCENTRATIONS

By Month

1974

Trailer	Item	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
020	Value (ug/m^3)	4483.8	1353.8	1853.7	1700.8	1716.6	3680.4	1811.5					
	Date	10/7	11/14	12/15	1/11	2/19	3/16	4/11					
	Time (MST)	5:50	11:55	13:30	19:30	10:05	11:25	13:35					
	Wind Direction (Deg.)	117	113	117	341	115	147	360					
	Wind Speed (MPH)	2	0	1	6	5	12	5					
023	Value (ug/m^3)	314201*	14563.1*	5061.4 *	2563.2 *	769.7	2421.1	740.9					
	Date	10/23	11/14	12/19	1/23	2/3	3/24	4/26					
	Time (MST)	2:50	15:25	4:50	17:15	15:05	13:20	7:20					
	Wind Direction (Deg.)	103	210	246	214	202	206	39					
	Wind Speed (MPH)	4	11	10	7	10	12	5					
021	Value (ug/m^3)												
	Date												
	Time (MST)												
	Wind Direction (Deg.)												
	Wind Speed (MPH)												
022	Value (ug/m^3)												
	Date												
	Time (MST)												
	Wind Direction (Deg.)												
	Wind Speed (MPH)												
.024	Value (ug/m^3)												
	Date												
	Time (MST)												
	Wind Direction (Deg.)												
	Wind Speed (MPH)												

*Contaminated manifold

NO
Constituent

TABLE II C-13

1 - HOUR MAXIMUM CONCENTRATIONS

By Month

Trailer	Item	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
020	Value (ug/m^3)	26.8	44.3	16.4	43.7	7.8	4.7	27.1					
	Date	10/6	11/10	12/9	1/22	2/19	3/19	4/26					
	Time (MST)	19:55	5:50	7:05	7:30	9:35	19:15	14:30					
	Wind Direction (Deg.)	102	131	106	105	126	122	235					
	Wind Speed (MPH)	0	0	2	1	8	4	11					
023	Value (ug/m^3)	124.5	38.5	93.9	114.2	52.6	16.7	10.1					
	Date	10/1	11/28	12/24	1/17	2/9	3/17	4/27					
	Time (MST)	2:45	8:10	1:05	9:55	9:25	11:40	7:25					
	Wind Direction (Deg.)	150	303	263	116	179	9	328					
	Wind Speed (MPH)	2	11	4	3	11	10	11					
021	Value (ug/m^3)												
	Date												
	Time (MST)												
	Wind Direction (Deg.)												
	Wind Speed (MPH)												
022	Value (ug/m^3)												
	Date												
	Time (MST)												
	Wind Direction (Deg.)												
	Wind Speed (MPH)												
024	Value (ug/m^3)												
	Date												
	Time (MST)												
	Wind Direction (Deg.)												
	Wind Speed (MPH)												

NO_2
Constituent

TABLE II C-14

1 - HOUR MAXIMUM CONCENTRATIONS By Month

1974

Trailer	Item	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
020	Value (ug/m^3)	55.5	26.7	36.0	17.6	14.4	11.2	16.7					
	Date	10/4	11/26	12/3	1/25	2/1	3/19	4/18					
	Time (MST)	8:20	22:30	17:10	6:35	0.45	18:40	16:20					
	Wind Direction (Deg.)	104	95	120	106	107	137	277					
	Wind Speed (MPH)	0	3	0	4	2	5	11					
023	Value (ug/m^3)	35.4	21.2	47.0	68.2	9.2	4.8	10.1					
	Date	10/1	11/26	12/6	1/16	2/23	3/23	4/28					
	Time (MST)	1:10	16:00	13:10	9:15	20:10	7:10	19:40					
	Wind Direction (@30')	144	315	57	143	179	146	60					
	Wind Speed (@ 30')	2	7	5	4	4	4	6					
021	Value (ug/m^3)												
	Date												
	Time (MST)												
	Wind Direction (Deg.)												
	Wind Speed (MPH)												
022	Value (ug/m^3)												
	Date												
	Time (MST)												
	Wind Direction (Deg.)												
	Wind Speed (MPH)												
024	Value (ug/m^3)												
	Date												
	Time (MST)												
	Wind Direction (Deg.)												
	Wind Speed (MPH)												

O_3

Constituent

TABLE II C-15

1 - HOUR MAXIMUM CONCENTRATIONS

By Month

Trailer	Item	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
020	Value (ug/m^3)	122.1	108.1	117.9	130.9	146	146.2	115.3					
	Date	10/1	11/27	12/12	1/29	2/19	3/26	4/22					
	Time (MST)	11:40	11:50	11:45	12:00	15:55	9:00	11:50					
	Wind Direction (Deg.)	275	141	133	124	184	130	221					
	Wind Speed (MPH)	2	-	0	4	7	4	9					
023	Value (ug/m^3)	104.5	64.6	68.5	97.7	136	145.9	116.1					
	Date	10/2	11/18	12/30	1/28	2/23	3/8	4/27					
	Time (MST)	17:10	13:20	13:25	13:15	21:45	11:40	14:20					
	Wind Direction (Deg.)	214	209	-	269	306	197	276					
	Wind Speed (MPH)	9	20	2	12	3	15	9					
021	Value (ug/m^3)												
	Date												
	Time (MST)												
	Wind Direction (Deg.)												
	Wind Speed (MPH)												
022	Value (ug/m^3)												
	Date												
	Time (MST)												
	Wind Direction (Deg.)												
	Wind Speed (MPH)												
024	Value (ug/m^3)												
	Date												
	Time (MST)												
	Wind Direction (Deg.)												
	Wind Speed (MPH)												

wind direction, but these are not well established and are of limited value in the interpretation or verification of the data. The great majority of the daily averages for either of these gases are zero. (See complete data reports for explanation of zero instrument reading.) In contrast to the first quarter's data, where the highest and more persistent H_2S and SO_2 ambient concentrations occurred in the Piceance Creek Valley and in particular, at Trailer 021, the January through April data show these gases to be in higher concentrations on the plateau. The highest one hour SO_2 average from January through April occurred at Station 024 on the plateau. The high H_2S one hour averages in January and March are measured at Trailer 023 on the plateau with the April high measured at Station 024 (Table II C-7 and II C-8). However, as mentioned above, these patterns do not exhibit the consistence that would be necessary in identifying the source(s) of these gases. It is known, however, that there are developed gas fields in the vicinity of the Tract and it is conceivable that these could be sources of sulfur gases such as H_2S which would undergo further oxidation in the atmosphere to produce SO_2.

During the January through April period the hourly average ozone concentrations at Trailer 020 in the Piceance Creek valley continue to show a diurnal trend, similar to that reported in Quarterly Report #2 with peak concentrations occurring around mid-day. The monthly averaged diurnal trend graphs in the monthly data reports indicate that during this period the peak broadens as the number of daylight hours increases, i.e. in December the peak occurred between approximately 9:00 a.m. and 7:00 p.m., while in April the peak occurs between approximately 7:00 a.m. and 10:00 p.m. The monthly one hour averages and the one hour maximum sliding averages through March (Table II C-15) indicate higher ozone concentrations at Trailer 020 in the valley than at the plateau Trailer 023. But in April, this situation is reversed with the higher ozone levels occurring at the plateau Trailer. The monthly one hour averages in the Radian data reports show that the ozone concentrations increased to a maximum in February and then show a decline through April for Trailer 020. On the other hand, Trailer 023 shows a steadily increasing ozone concentration through April. Table II C-15 shows the maximum one hour sliding average for Trailer 020 occurring in February and March and for Trailer 023 in March with both trailers indicating lower maximums for April. Diurnal ozone trends at the plateau Trailer 023 are not as well established as they are in the valley throughout the December - March period. The peak is less pronounced and its onset and decline less obvious. In April, however, the trend is much better defined and the peak occurs between approximately 8:00 a.m. and 10:00 p.m. The monthly one hour ozone averages show almost perfect agreement between Trailer 020 and 023 for the time of occurrences of the maximum concentrations. The Marlatt Temperature-Inversion Report (Reference 10 in the data report) indicates that inversion breakup occurs more frequently at an earlier hour in April than in the preceding months and not as intense as in the preceding months. This would favor better atmospheric mixing and may result in a more homogenous air mass over the Tract and in the valley. This could account for the increased similarity in the valley and plateau diurnal ozone trends. In general, the data indicate some rather high one hour average values for the ozone concentrations as do the monthly averages. In this respect it is worthwhile to note that the increased and widespread national monitoring programs have found high ozone levels in supposedly unpolluted rural environments also.

Although the diurnal ozone trend at Trailer 020 and to a lesser extent at Trailer 023, exhibits the classical profile of the ozone peak evolution in a photochemical smog, there are additional data in the Radian reports that need to be closely examined. In general, the nitric oxide and nitrogen dioxide diurnal trends are not typical of a photochemical smog. An examination of the diurnal monthly averages for these two gases does reveal at times a pattern vaguely similar to that found in a photochemical smog, but these are almost always out of phase with the ozone peak. Furthermore, daily monthly averages for nitric oxide, nitrogen dioxide and non-methane hydrocarbons indicate very low ambient concentrations at a time when the daily and monthly ozone levels are at their highest (See Radian April data report.) Furthermore, an examination of the diurnal tables for these gases and carbon monoxide does not indicate a pattern that might identify them as an anthropogenic pollutant associated with a definite source, such as automobile exhaust, which could result in the buildup of pollutants necessary for the photochemical formation of ozone.

Some explanation of the hydrocarbon and carbon monoxide data at Trailer 023 is needed. It was mentioned in Summary Report #2 that the sampling manifold in Trailer 023 had become contaminated and that the hydrocarbon data were not representative of the ambient air concentrations. It was not until after January 19 that this contaminated manifold was replaced, after attempts to clean it had failed to remove the source of contamination. It is obvious from the significantly lower daily averages for the non-methane hydrocarbons reported after January 22 that the interferring contaminants have been removed.

The carbon monoxide (CO) concentrations are measured by the same instrument used to measure the hydrocarbon concentrations. The daily CO averages through January 30 at Trailer 023 frequently exceed the Trailer 020 values by at least a factor of two. Then on February 4 when data collection resumed, the Trailer 023 CO values are less than one half of those reported prior to January 30. The operator's log for Trailer 023 shows that the hydrogen regulator, and the analytical and stripper gas chromatography columns were replaced during the January 31 to February 3 period. Although any one or all of these actions could have removed an interferring contaminant, it is quite probable that the chromatographic columns had been contaminated previously by the contamination discovered in the sampling manifold mentioned above.

The daily ambient hydrocarbon data for both trailers declined to a low in February and March, and then increased in April, especially at Trailer 020 in the valley. The April 6:00 - 9:00 a.m. maxima in Table II C-10 exhibit rather large increases over the February and March maxima. This increase may be associated with the warmer temperatures and/or increased vegetation growth which could enhance the presence of the volatile natural organics in the atmosphere.

The particulate data as shown in Table II C-9 for December through February are only a fraction of the ambient particulate concentrations reported in the first quarter. The snow cover and somewhat decreased activity on Tract during this period would explain this decrease. The March and April data show an increase above these concentrations with the April monthly averages showing a threefold increase (see Radian March and April data reports). Table II C-9 also shows the high particulate loadings at all of the stations for the month of April that are associated with higher wind speeds.

Trace element analyses of the quarterly composite of cellulose filter samples collected at Trailer 023 are not reported in Quarterly Report #3, but will be included in Quarterly Report #4. However, samples of volatile trace metals, such as selenium, arsenic, and mercury, were collected in April, and the data are included in Quarterly Report #2. These concentrations are selenium (expressed as selenium dioxide), 0.38 ug/m^3, mercury, .0055 ug/m^3, and arsenic (expressed as arsine), 9.74 ug/m^3.

Regarding near-surface meteorology, Table II C-16 presents a meteorological summary for winds and temperature in a new format adapted so as to show annual trends. Maximum hourly temperature achieved to date was 81°F in October; a minimum of -51°F was reached in January. The hourly minimum was achieved in Piceance Canyon at Rock School (Trailer 021); for this same month the minimum on the plateau at the base of the meteorological tower was -5°F. As previously cited in the prior Summary Report a strong near-surface horizontal temperature gradient can also exist in Piceance Canyon in the presence of vertical temperature inversions; the horizontal gradient dissipates as the inversions dissipate.

Maximum wind speeds (5-minute) have reached 53 mph, achieved on the plateau in April with gusts to 79 mph. Hourly average wind speeds have ranged from 2 to 10 mph, generally higher on the plateau. Wind directions are generally down-slope, down-valley at night and up-slope, up-valley during the day. Wind-directional persistence in the canyon is of particular interest with regard to ability of the entrained air mass to "flush itself out" as opposed to "sloshing

(Text Continued on Page 119)

TABLE II C-16

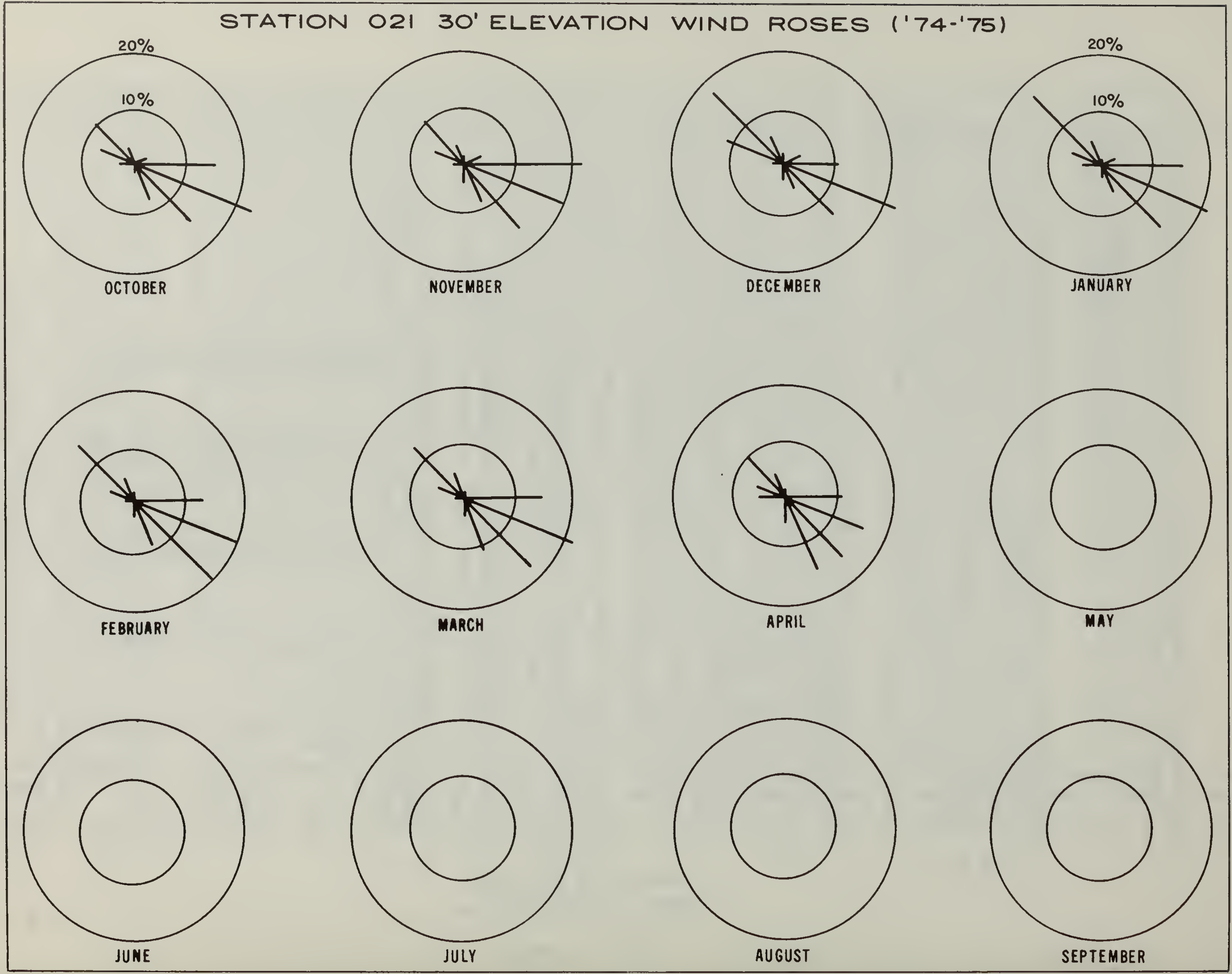
METEOROLOGICAL SUMMARY
Winds and Temperature

By Month

Trailer	Item	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
020	Temperature, Hourly Max (^oF)	71	50	45	50	47	59	69					
021		72	52	46	53	49	57	68					
022		72	53	47	53	47	55	68					
023		81	48	49	43	42	50	68					
024		-	-	37	51	47	55	62					
020	Temperature, Hourly Min (^oF)	18	-14	-30	-46	-24	-28	-19					
021		14	-17	-34	-51	-29	-28	-21					
022		24	0	-22	-38	-22	-23	-15					
023		24	5	0	-5	0	-6	6					
024		-	-	-8	-29	-10	-18	-5					
020	Temperature, Hourly Average (^oF)	41	27	13	15	19	32	36					
021		39	27	11	15	20	30	35					
022		43	29	15	18	21	30	36					
023		46	32	25	23	24	31	35					
024		-	-	15	22	24	32	38					
Tower, 200'	Wind Speed, 5-Min Max (MPH)	31	39	52	48	36	52	53					
020	Wind Speed, Hourly Max (MPH)	10	11	11	18	18	17	24					
021		17	19	13	19	17	20	28					
022		12	15	20	18	17	19	17					
023		21	25	38	32	24	38	43					
024		-	19	25	25	20	33	37					
020	Wind Speed, Hourly Average (MPH)	2	3	3	5	5	5	6					
021		3	3	4	6	6	6	6					
022		5	5	5	6	6	6	6					
023		2	7	7	8	8	10	10					
024		-	3	3	5	5	7	7					

Winds @ 30' except where noted.

FIGURE II C-1



STATION 021 30' ELEVATION WIND ROSES ('74-'75) back and forth." Using Station 021 at Rock School as an example, monthly (directional only) wind roses are presented on Figure II C-1 to show frequency of 5-minute samples with regard to wind direction. The majority of the down-Piceance and up-Piceance directions is illustrated on a cumulative basis (October through April) in the following table:

Down Piceance (ESE, SE)	36.94%	of the time
Up Piceance (WNW, NW)	18.89%	" " "
Subtotal	56.83%	
East	14.62%	" " "
All Others	28.55%	
Total	100.00%	" " "

II C-2 Low Altitude Meteorology

Low altitude meteorological data are obtained at 8', 30', 100', and 200' on the meteorological tower at Station 023.

Whereas the dominant wind direction in Piceance Canyon at Rock School was down-canyon (ESE-SE), the dominant direction on the tower at 100' as shown on Figure II C-2 is down-slope from the south-southwest (SSW) for the December-January-February quarter. This represents a shift from predominantly southerly winds of the previous quarter reported in the prior Summary Report.

II C-3 Upper Air Studies

Three 15-day quarters of upper atmospheric studies have been completed. From the temperature soundings the number of days are presented for which inversions have occurred in the canyons below the tract (designated "C" on Table II C-17), above the tract surface at the meteorological tower (designated "T"), days with C or T and days with both C and T. On a cumulative basis, the percentages are 41.5, 70.8, 85.3 and 26.8 respectively. For the present quarter a statistical analysis of the number of inversions and their average height and duration is presented on Tables II C-18 and II C-19 as obtained from the acoustic sounder.

Atmospheric stability has been assessed from multiple sources in the 24-hour "quick-look" tests of January 28-29 and April 28-29. During the April 28-29 test, four techniques were compared:

a. The temperature soundings at the C-b Tract;

b. Temperature soundings at Grand Junction;

c. ΔT's between 200' and 30' and between 100' and 30' on the meteorological tower;

d. Standard deviations of the bivane wind directional components.

Ranges of Pasquill-Gifford atmospheric stability classes corresponding to ranges in slopes of the temperature-altitude curve (dT/dz).

FIGURE II C-2

QUARTERLY WIND ROSE - 100' LEVEL
DEC. '74 - FEB. '75

TOTAL % OF CALMS DISTRIBUTED BELOW (0.14%)

PERCENTAGE OF A STABILITY - 26.32
PERCENTAGE OF B STABILITY - 22.98
PERCENTAGE OF C STABILITY - 26.38
PERCENTAGE OF D STABILITY - 17.84
PERCENTAGE OF E STABILITY - 6.37

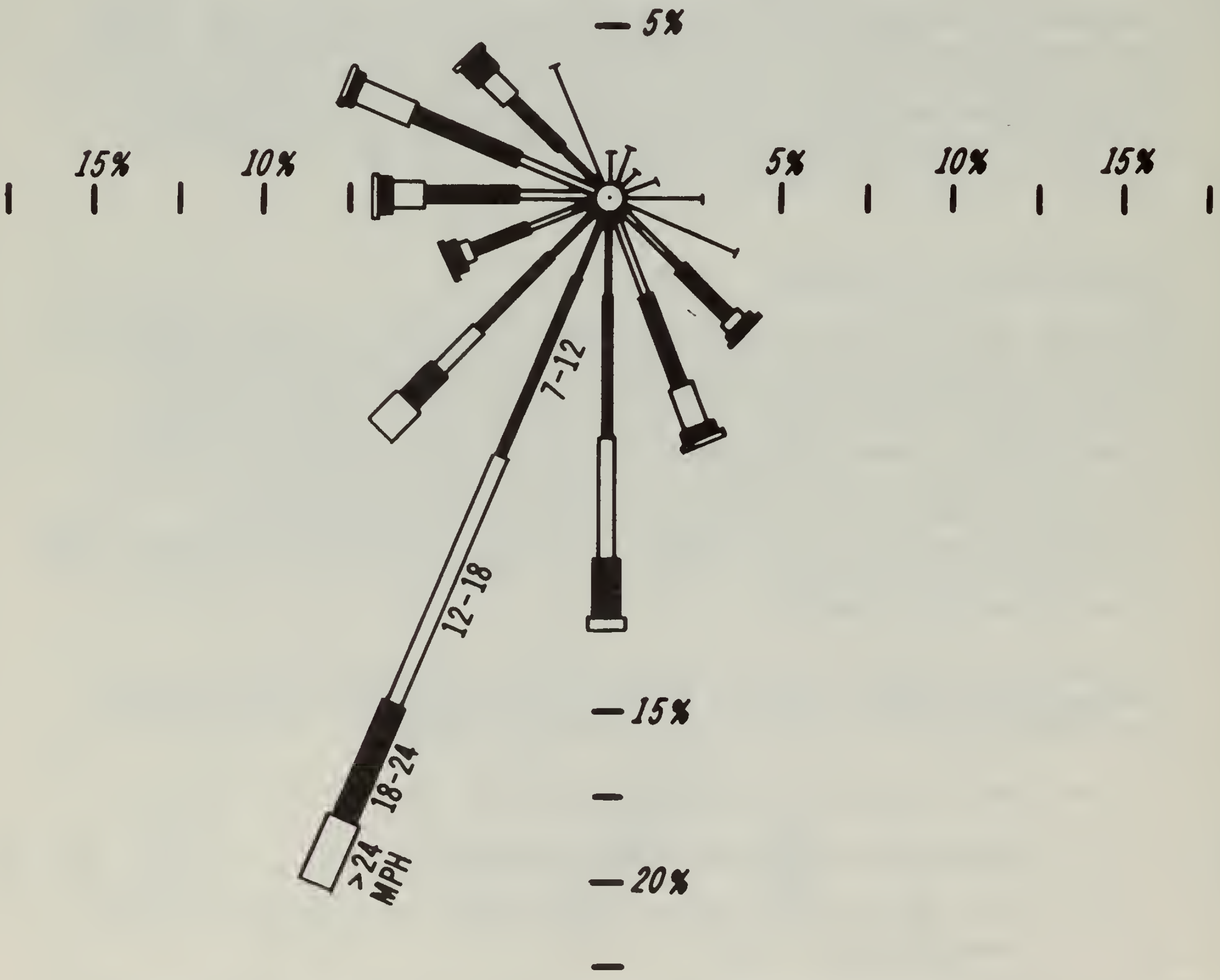


TABLE II C-17

SUMMARY OF INVERSIONS AT THE C-b TRACT

(Source: Temperature vs. Altitude Data)

Item	Fall '74	Winter '75	Spring '75	Summer '75	Cumulative
	(Oct.)	(Jan.)	(Apr.)	(July)	
No. of Days with Inversions					
In Canyons below Tract (=C)	4	8	5		17
Above Tract Surface (=T)	11	11	7		29
C or T	12	13	10		35
C and T	3	6	2		11
No. of Successful* Days without Inversions	0	2	4		6
Total No. of Successful* Days	12	15	14		41
Percentage of Days with Inversions					
C	33.3	53.3	35.7		41.5
T	91.6	73.3	50.0		70.8
C or T	100.0	86.6	71.4		85.3
C and T	25.0	40.0	14.3		26.8

*A "success" is defined here as one for which (a)at least two successful flights were obtained and for which one of the flights was either at nominally 6 am or 9 am or (b) one inversion was obtained.

Table II C-18. Air temperature inversion characteristics from the acoustic sounder. C-b tract near meteorology tower and air quality monitoring station. March 1, 1975 to May 31, 1975.

	March	April	May
Number of inversions	29	27	27
Average duration (hours)	6	4	5
Average height (feet)	1015	655	685
Number of days of measurements	27	21	29
Number of days of missing data	4	9	2

Table II C-19. Frequency analysis of air temperature inversion duration. C-b tract near meteorology tower and air quality monitoring station. March 1, 1975 to May 31, 1975.

Inversion Duration (hrs)	March	April	May	Total	Per Cent
0 - 3.9	9	14	8	31	37
4 - 6.9	9	9	10	28	34
7 - 9.9	4	2	8	14	17
10 - 12.9	5	2	1	8	10
13 - 15.9	2	0	0	2	2

horizontal wind direction standard deviation (σ_Θ), and vertical wind direction standard deviation (σ_ϕ) are presented in Table II C-20. Utilizing these techniques, results of the stability comparison from the April 28 test are presented in Table II C-21. Thus stability class as indicated by tower and temperature sounding agree fairly well (within one class). The previous quick-look report showed that the pyranometer technique agreed reasonably well with the tower ΔT's and soundings. Short averaging times (much less than 5-minute averages) are required to utilize bivane components for stability class determinations.

II C-4 Visibility

There are no visibility requirements in the lease stipulations; site visibility measurements are required in the conditions for approval by the Mining Supervisor.

A joint proposal request with the Rio Blanco Oil Shale Project has been prepared and a contract is being negotiated with Dames and Moore; work is expected to start as soon as a shelter is constructed and installed at the Hunter Creek site. The selected area-wide technique utilizes photographic photometry. The visual range will be measured every sixth day during a one year period. On that day, photographs will be taken of four views covering an approximate 90° north to east sector from the Hunter Creek site.
Each view will be shot seven times throughout the day with black and white and color film. The difference in the measured film emulsion density between the target object image and the background sky is used to compute the visual range in miles.

II C-5 Atmospheric Diffusion Studies

There are no requirements in the lease stipulations for atmospheric diffusion studies. Conditions for approval from the Mining Supervisor require X/Q (ambient concentration level/stack emission rate) estimates for 24-hour and 3-hour averages.

Phase I of these studies will be completed this summer utilizing a Gaussian plume analysis for dispersion of stack effluents and a simplified "box" model in segments of Piceance Canyon for auto/truck emission dispersion analysis. Model refinements and further field experimentation may be undertaken as more basic input meteorological and plant-design data become available.

An assessment of atmospheric stability will probably be required for input to the diffusion models. This assessment has been initiated and is reported in the references contained at the end of Quarterly Report #3.

TABLE II C-20

DETERMINATION OF PASQUILL-GIFFORD STABILITY CLASSES FROM VARIOUS SOURCES

Pasquill-Gifford Stability Class	Slope of the Temperature-Altitude Curve dT/dz (^{o}C/100m)	Standard Deviations of Wind Direction Components	
		Horizontal σ_θ (Deg.)	Vertical σ_ϕ (Deg.)
A	<-1.9	>23	
B	-1.9 to -1.7	18 to 23	>15
C	-1.7 to -1.5	13 to 18	9 to 15
D	-1.5 to -0.5	8 to 13	6 to 9
E	-0.5 to 1.5	4 to 8	2 to 6
F	1.5 to 4.0	2 to 4	0 to 2
G	>4.0	<2	

TABLE II C-21

Stability Classes from Various Sources

4/28/75

Elevation (ft. above mean sea level)	Height above surface @ Tower (Ft)	Slope of Temp.-Alt. (°C/100m) (with Stability Class in Parenthesis)				Source
		05:27 MST @ C-b	08:25 MST @ C-b	11:27 MST @ C-b	05:00 MST @ Grand Junction	
7000	0	-1.3 (D)*	-.7 (D)	-.53 (D)	-.78 (D)	Temp. Sounding
7065	65	-2.4 (A)	-.7 (D)	-.53 (D)		
7115	115	-.53 (D)	-.7 (D)	-1.4 (D)		
7200	200	-.53 (D)	-.7 (D)	-1.4 (D)		
7400	400	-.53 (D)	-.7 (D)	-1.2 (D)		
7600	600	-.56 (D)	-1.1 (D)	-1.2 (D)		
7800	800	-.59 (D)	-1.1 (D)	-.78 (D)		
8000	1000	-.62 (D)	-.9 (D)	-.68 (D)		
7065	65	-.17 (E)	-.4 (E)	-.4 (E)		Met. Tower ΔT
7115	115	-.21 (E)	-.52 (D)	-.54 (D)		
7200	200			†Averaging Time (sec) (E)	(D)	Bivane:
				1-2	2-5	Vert. Comp.
				25-46	46-80	Hor. Comp.

Note: For bivane, averaging-time ranges are those to yield stability class indicated at 11:27 MST at C-b.

* For definition of stability classes see Table II C-20.

II D BIOLOGY

The biological studies in this quarter are discussed in the following sections:

II D-1 Terrestrial Wildlife Studies

Big Game, Medium-Size Mammals, Small Mammals, and Birds

II D-2 Aquatic Studies

Fish, Benthos, Periphyton, Primary Production, Water Quality, and Sediment

II D-3 Terrestrial Vegetation Studies

II D-4 Dendrochronology and Dendroclimatology

II D-5 Soil Survey and Productivity Assessment

Soil Mapping and Profile Description, Soil Sample Collection, Soil Chemical Analysis, and Soil Productivity Assessment Studies

II D-1 Terrestrial Wildlife Studies

The wildlife program during this quarter included studies on big game, medium-sized mammals, small mammals, and birds. Permanent study areas for these wildlife groups have been represented on figures in Quarterly Report #1.

The importance of Tract C-b to big game from March 1975 to June 1975 was evaluated through monthly air reconnaissance flights, track counts, road counts, pellet group counts, browse survey, and mortality survey.

As stated in Quarterly Report #1 (December 1974), deer moved very abruptly into the C-b area during early October. This fall influx occurred during mild, snow-free weather, and was probably related to vegetational changes rather than to weather per se. Although what actually initiated the fall migratory movement is unclear, it is certain that several agricultural meadows immediately north of Tract C-b attracted large numbers of deer.

Deer remained in the C-b area until the second week of May, and during this time a considerable research effort was devoted to studying local movements: where deer crossed roads; concentration and dispersal times, if apparent; habitats most frequently used; and the extent and direction of local travel routes.

Both fall and spring migratory movements into and out of the C-b area occurred quickly, each probably in less than than a two-week period. Field observation as well as road count data support this conclusion. It appears that these seasonal movements were related to vegetational changes rather than to weather. Some snow remained at the higher elevations in mid-May when the spring migratory movement occurred, but not enough to present a barrier to movement. Many ridges, in fact, were snow free. Behavioral disturbances (hunters during the fall, machinery clearing irrigation ditches in the spring) seem not to have been important factors.

Deer road count information helps to explain in part the local movements of deer while they are on winter range, as well as the habitats utilized. A more thorough treatment requires results from other studies. Nevertheless, it can be stated that deer used the agricultural meadows along Piceance Creek during October and November, and again in late March, April, and early May. Virtually no use was made of them in December, January and February when the meadow vegetation became dry and dormant. During this mid-winter period the deer did not move to distant localities, but only to nearby upland areas. They remained somewhat dispersed throughout a variety of vegetation types at this time, although local and temporary concentrations occurred which were largely related to deep snow conditions. South-facing slopes became important in late winter, particularly during times of deep and crusted snow. The majority of the deer seen from the road during February were observed feeding on these slopes near the highway. Indian rice-grass (palatable deer forage) appears to have initiated new growth in mid-March on south-facing slopes. During this late winter period, many deer also began feeding on hay stacks in the agricultural meadows. Such behavior is often indicative of poor or unavailable (e.g., snow covered) browse conditions. While deer are known to starve while feeding only on cured hay, no dead deer were found close to these hay stacks. It appears, therefore, that south-facing slopes may be critical to the over-winter survival of deer, at least in some years, since they are utilized when deep, crusted snow occurs elsewhere and again at the end of winter when they become the first areas warmed sufficiently to permit spring growth.

Air reconnaissance flights which were conducted once each month, following fresh snow falls, from December through April, are useful in describing local distributions in the more inaccessible places (Figures II D-1 and 2 in this report; also Figures II D-1 and 2 in Summary Report #2). Zones depicting relative deer abundance should be interpreted as generalizations. Changes in total area of these zones from month to month reflect shifts in distribution, not changes in density.

Pellet group surveys at 16 established transects showed that the greatest deer days use/acre and deer/acre occurred in the plateau sagebrush and chained pinyon-juniper vegetation types while the least

(Text Continued on Page 130)

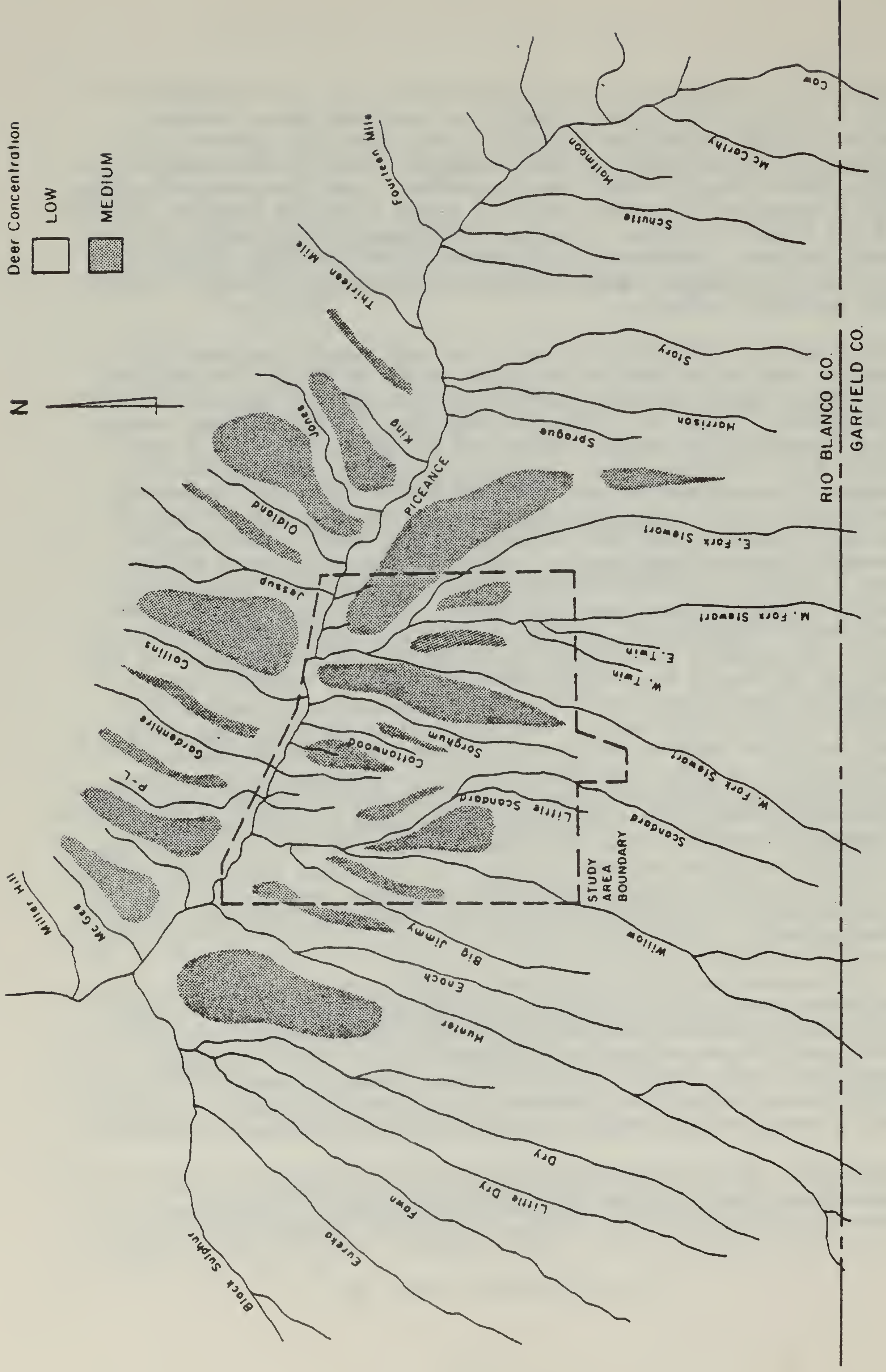


Figure II D-1
Distribution of deer during mid-March 1975

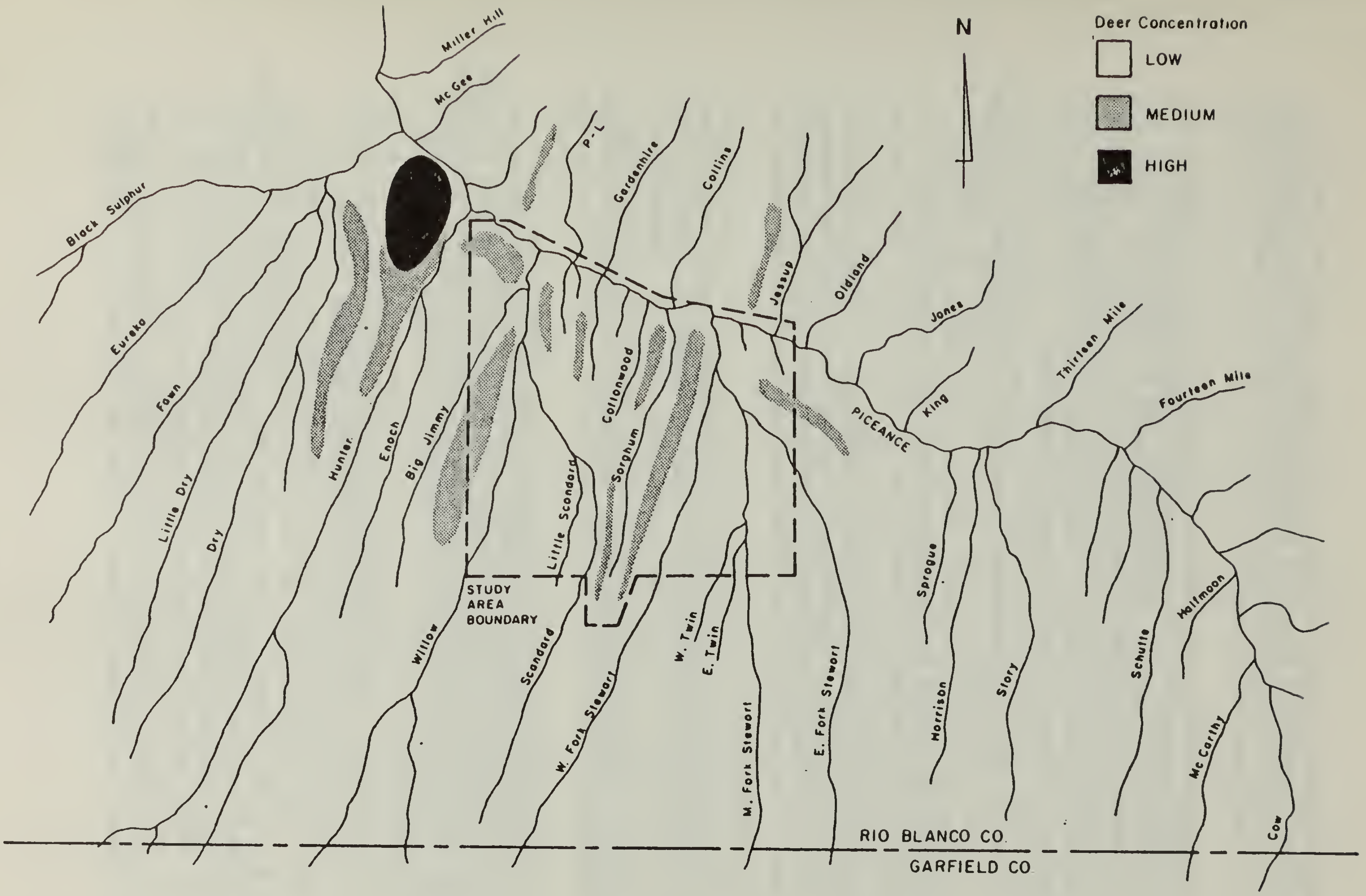


Figure II D-2

Distribution of deer during early April 1975.

use occurred in the valley sagebrush. The plateau sagebrush appears to be heavily utilized when deep snow conditions exclude other areas from browsing. Total deer numbers on Tract C-b over the winter were estimated at 625, assuming no winter mortality.

The browse evaluation survey conducted within the above 16 transects revealed that big sagebrush is the most important browse species on Tract because of its density, palatibility, and distribution. This species provided 45.4 percent of the deer's diet. Antelope bitterbrush, mountain mahogany, rabbitbrush, and serviceberry combined provided 47.5 percent of the deer's diet. In the early spring grasses were also important to the deer prior to the spring migration.

Road counts and age class determinations suggest an approximate 40 percent decline in the fawn population over winter. In November the ratio of fawns to does was 133:100; in March the ratio had decreased to 96:100; and in May it was 75:100. On-going mortality studies will provide additional information not yet analyzed.

Medium-sized mammals were not plentiful this quarter. Track counts indicated the presence of the cottontail rabbit in all habitat types. The coyote was found in the pinyon-juniper woodland while the deer was widespread. The yellow-bellied marmot and the porcupine were observed during this quarter.

Weather is an important factor which influences small mammal activity. During the March field survey three species were captured. These included the deer mouse, montane vole, and least chipmunk. During this time the warm weather was followed by a storm and the chipmunks disappeared again. The deer mice and voles, however, remained active through the late winter.

During the May field survey six species of small mammals were live-trapped. These included the deer mouse, apache pocket mouse, montane vole, least chipmunk, colorado chipmunk, and golden mantle ground squirrel. The most abundant species were the deer mouse, least chipmunk, and Colorado chipmunk. The majority of these species were adults and were in reproductive condition.

Recapture statistics revealed that approximately 70% of all deer mice marked in the fall of 1974 were not present in May 1975. On the other hand, approximately 80% of the marked chipmunks were still present in May 1975. This suggests that the deer mice suffered a higher mortality rate than did the chipmunks. The montane vole, in contrast, was virtually absent from all traps. Avifauna surveys of contents of pellets suggest that the vole population experienced significant predation pressure over the winter.

One additional finding was noted regarding habitat preference of the least chipmunk and Colorado chipmunk. From an examination of capture locations for the two species it is apparent that the Colorado chipmunk prefers sandstone rimrock, dry canyons and xeric hillsides. The least chipmunk on the other hand was most commonly trapped on ridgetop pinyon-juniper woodlands and moist hillsides on north slope exposures.

Eight species of birds representing 43 individuals were recorded in the four transects during March. Twenty-seven species representing 971 individuals were recorded during qualitative count surveys made in mid-March, 1975. The tendency for many avian species to form flocks which drift from habitat to habitat during fall and winter accounts for the variability in data collected to date. Habitat-specific utilization by different species should become apparent during census to be conducted in May. By late-May, species of birds which will nest in tract habitats should be present, and males should be defending spatially-fixed territories.

Diversity between the 27 species encountered was numerically dominated by the red-winged blackbird which had a relative abundance of 55 percent. This species was found in large numbers along Piceance Creek and Willow Creek. Other species that typically form winter flocks showed relative abundance as follows: mallard (4.0 percent), the dark-eyed junco (6.0 percent) and the gray headed junco (10.3 percent), the common raven (8.0 percent), and the mountain bluebird (2.4 percent).

Mourning doves, the only upland gamebird species thus far encountered in the study area, had reappeared in the Piceance Basin by early April. On April 13, 1975, doves were recorded in small numbers at Tract C-b along Piceance Creek.

Waterfowl observations during this period documented six species representing 184 birds. Mallards and green-winged teal were the dominant waterfowl.

The common raven was the most frequently encountered raptorial bird during the reporting period. The red-tailed hawk had returned to the Piceance Basin while the rough-legged hawk, a species which was common during mid-winter, was observed only two times during March. Golden eagles were observed on 12 occasions. In March, three different bald eagles were observed. American kestrels, northern shrikes, and loggerhead shrikes were seen throughout most vegetation types. The great horned owl was the only nocturnal species recorded.

II D-2 Aquatic Studies

The aquatic studies for this quarter included fish, benthos, periphyton and water quality. Locations of sampling stations and their descriptions are included in Quarterly Report #1; however, inadvertent sample station number transpositions occurred in the water quality and benthos collections for the White River stations #1 and #2. This has been corrected in this report.

Fish

Fish were collected in March and May, however, high flows and turbid conditions during May made sampling difficult. The species of fish collected were the same as those collected in previous sampling periods. Brook trout were the most abundant species captured, followed by mountain sucker and speckled dace. The brook trout were concentrated in Lower Stewart Lake, the channel leading from the lake into Stewart Creek and in the Stewart Creek sampling area S-2. In addition, a few brook trout were taken in Piceance Creek and Willow Creek. The capture of a number of brook trout fingerlings in Lower Stewart Lake and the channel leading from the lake in May indicates successful spawning of this species in these areas in the fall of 1974. Conditions favorable to the spawning of brook trout exist in Lower Stewart Lake, and spawning probably occurs there, and may also occur in the channel leading from the lake in Stewart Creek.

Length-frequency analyses indicate that the majority of brook trout are in their second year (Figure II D-3). The presence in the analysis of brook trout fingerlings decreased the mean length of the population from that of the last quarter. Mean lengths and weights of fish captured during March and May are shown in Tables II D-1 and 2.

Benthos

Benthic invertebrates were collected from all aquatic stations in March except for Upper Stewart Lake, which was frozen over. In May all stations were sampled except for WR-1 on the White River, which was too deep and swift to sample benthos. The numerical abundance and species numbers of the benthic invertebrates are presented in Tables II D-3 through II D-6.

Benthic invertebrates represented three phyla: Annelida, Arthropoda, and Mollusca. Arthropods were again the most numerous group. During winter sampling periods beetles, caddisflies, true flies, stoneflies, damselflies and dragonflies decreased drastically or disappeared. Mayflies stabilized at a low level. In spring sampling, mayflies, stoneflies and true flies increased significantly. Damselflies and dragonflies, which occur only in the lakes, were reappearing. Beetles were also returning, although in small numbers.

Shifts in biomass and species diversity are attributed to seasonal changes. These changes are probably natural and reflect both quantitative and qualitative changes in the fauna and their aquatic environment over time.

Periphyton

Periphyton analyses from April and May were not completed in time to be included in this Quarterly Report.

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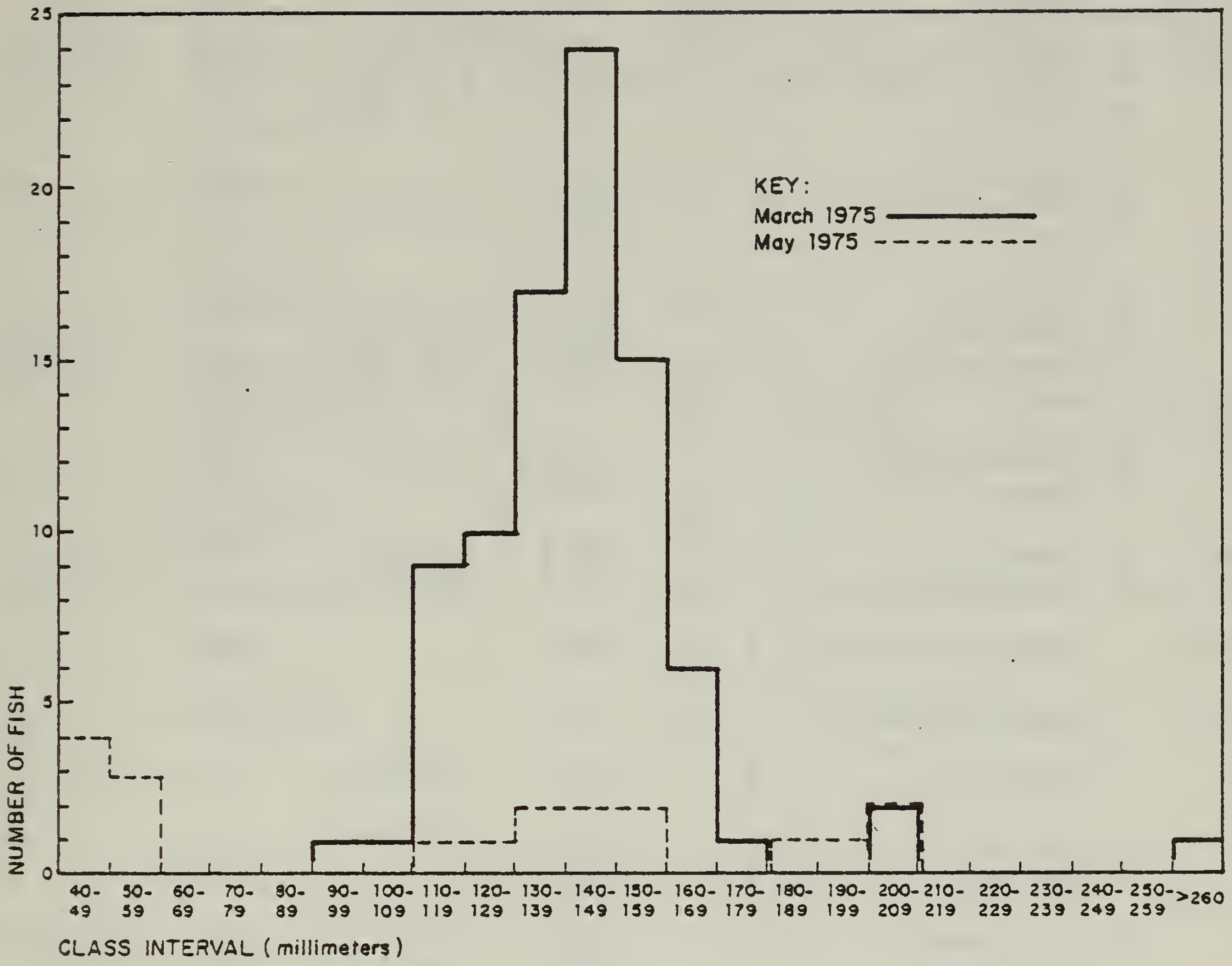

Figure II D-3

Length-frequency distribution of Brook Trout captured in Piceance Basin over two sampling periods, March and May 1975.

TABLE II D-1

MEAN LENGTHS AND WEIGHTS OF FISH CAPTURED DURING MARCH 1975 FROM PICEANCE, STEWART AND WILLOW CREEKS, AND THE WHITE RIVER

Station	Species	Number Collected	Mean Length (mm)	Range (mm)	Mean Weight (gm)	Range (gm)
P-1	*S. fontinalis*	2	120.0	(112-128)	18.0	(16- 20)
	C. platyrhynchus	20	128.7	(94-152)	25.3	(20- 40)
	R. osculus	3	79.3	(70- 84)	6.7	(6- 8)
P-2	*S. fontinalis*	1	116.0	-	12.0	-
	C. platyrhynchus	5	146.6	(127-201)	33.4	(20- 81)
	R. osculus	1	76.0	-	4.0	-
P-3	*S. gairdneri*	1	225.0	-	130.0	-
	S. fontinalis	2	120.5	(102-139)	27.0	(22- 32)
	C. platyrhynchus	2	146.5	(98-195)	96.0	(8-184)
	R. osculus	12	72.5	(52- 85)	5.3	(2- 8)
P-5	*C. platyrhynchus*	3	141.7	(118-177)	30.0	(14- 56)
	R. osculus	1	87.0	-	5.0	-
P-5A	*S. fontinalis*	2	232.5	(153-312)	157.5	(40-275)
	C. platyrhynchus	5	133.0	(124-144)	22.0	(20- 24)
P-7	*C. latipinnis*	1	415.0	-	744.0	-
W-3	*C. platyrhynchus*	1	83.0	-	12.0	-
S-2	*S. fontinalis*	7	128.1	(97-142)	21.7	(8- 24)
LSL	*S. fontinalis*	74	142.8	(114-209)	25.6	(9- 78)
	R. osculus	1	92.0	-	8.0	-
WR-1	*P. williamsoni*	3	340.0	(292-370)	280.0	(200-335)
	C. latipinnus	5	424.6	(386-466)	686.0	(480-920)
	C. bairdi	1	82.0	-	15.0	-
WR-2	*P. williamsoni*	1	345.0	-	354.0	-

Species Legend:
Salmo gairdneri - Rainbow trout
Salvelinus fontinalis - Brook trout
Prosopium williamsoni - Mountain whitefish
Catostomus platyrhynchus - Mountain sucker
Catostomus latipinnis - Flannelmouth sucker
Cottus bairdi - Mottled sculpin
Rhinichyhys osculus - Speckled dace

Station Legend:
P1-7: Piceance Creek
W1-3: Willow Creek
S1-2: Stewart Creek
WR1-2: White River
LSL: Lower Stewart Lake

TABLE II D-2

MEAN LENGTHS AND WEIGHTS OF FISH CAPTURED DURING MAY 1975 IN PICEANCE, STEWART AND WILLOW CREEKS

Station	Species	Number Collected	Mean Length (mm)	Range (mm)	Mean Weight (gm)	Range (gm)
P-1	*C. platyrhynchus*	1	132	-	20	-
P-2	*S. fontinalis*	1	51	-	<1	-
P-3	*S. fontinalis*	1	119	-	18	-
P-5	*C. platyrhynchus*	1	138	-	31	-
P-5A	*S. fontinalis*	1	192	-	78	-
	C. platyrhynchus	2	103	(87-120)	12	(6-18)
	R. osculus	4	74	(68- 82)	3.5	(2- 6)
P-6	*C. platyrhynchus*	1	90	-	8	-
	R. osculus	1	75	-	4	-
W-3	*S. fontinalis*	2	207	(206-208)	105	(100-110)
S-2	*S. fontinalis*	6	132	(104-154)	28	(12-40)
LSL	*S. fontinalis*	9	134	(42-180)	9.9	(1-30)

Species Legend:
Salvelinus fontinalis - Brook trout
Catostomus platyrhynchus - Mountain sucker
Rhinichyhys osculus - Speckled dace

Station Legend:
P1-7: Piceance Creek
W1-3: Willow Creek
S1-2: Stewart Creek
LSL: Lower Stewart Lake

TABLE II D-3

NUMBER OF INDIVIDUALS AND SPECIES OF BENTHIC INVERTEBRATES COLLECTED AT EACH BIOLOGICAL SAMPLING STATION FOR PICEANCE CREEK DURING MARCH AND MAY 1975

	Station																				
	P-1			P-2			P-3			P-5			P-5A			P-6			P-7		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
MARCH																					
Replicate Totals																					
Number of Individuals	47	21	43	150	132	44	61	83	137	36	48	52	24	93	81	5	44	16	12	51	18
Number of Species	4	4	5	8	7	9	8	7	8	5	9	9	5	8	8	2	5	3	2	4	4
Station Totals																					
Number of Individuals		111			326			281			136			198			65			81	
Number of Species		7			11			10			12			8			5			4	
MAY																					
Replicate Totals																					
Number of Individuals	10	15	14	60	29	11	15	3	20	14	53	7	13	27	53	16	72	13	31	7	57
Number of Species	4	5	5	7	6	4	3	3	4	3	5	3	6	8	10	4	4	5	2	1	4
Station Totals																					
Number of Individuals		39			100			37			74			93			101			95	
Number of Species		7			9			8			7			15			8			4	

TABLE II D-4

NUMBER OF INDIVIDUALS AND SPECIES OF BENTHIC INVERTEBRATES COLLECTED AT EACH BIOLOGICAL SAMPLING STATION FOR STEWART CREEK AND STEWART LAKES DURING MARCH AND MAY 1975

	Station											
	S-1			S-2			USL*			LSL		
	A	B	C	A	B	C	A	B	C	A	B	C
MARCH												
Replicate Totals												
Number of Individuals	59	103	45	8	13	6	-	-	-	389	78	521
Number of Species	9	6	7	5	3	4	-	-	-	2	3	2
Station Totals												
Number of Individuals		207			27			-			988	
Number of Species		11			9			-			3	
MAY												
Replicate Totals												
Number of Individuals	195	173	318	67	387	132	98	393	305	323	317	126
Number of Species	11	10	12	8	10	10	3	7	4	5	4	6
Station Totals												
Number of Individuals		686			586			796			766	
Number of Species		17			13			7			7	

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* Upper Stewart Lake was frozen over in March 1975.

TABLE II D-5

NUMBER OF INDIVIDUALS AND SPECIES OF BENTHIC INVERTEBRATES COLLECTED AT EACH BIOLOGICAL SAMPLING STATION FOR WILLOW CREEK AND WILLOW LAKES DURING MARCH AND MAY 1975

	Station														
	W-1			W-2			W-3			U.W.L.			L.W.L.		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
MARCH															
Replicate Totals															
Number of Individuals	31	35	40	19	2	14	9	8	4	39	52	76	64	45	59
Number of Species	3	3	5	2	1	2	3	3	2	3	3	6	3	3	5
Station Totals															
Number of Individuals		106			35			21			167			168	
Number of Species		5			3			4			7			5	
MAY															
Replicate Totals															
Number of Individuals	365	59	58	21	18	22	205	70	185	0	21	32	35	70	77
Number of Species	8	8	9	6	6	8	10	8	9	0	3	6	3	4	3
Station Totals															
Number of Individuals		482			61			460			53			182	
Number of Species		13			11			13			7			4	

TABLE II D-6

NUMBER OF INDIVIDUALS AND SPECIES OF BENTHIC INVERTEBRATES COLLECTED AT EACH BIOLOGICAL SAMPLING STATION FOR THE WHITE RIVER DURING MARCH AND MAY 1975

	Station					
	WR-1*			WR-2		
	A	B	C	A	B	C
MARCH						
Replicate Totals						
Number of Individuals	130	182	169	45	102	42
Number of Species	5	6	8	4	6	6
Station Totals						
Number of Individuals		481			189	
Number of Species		10			7	
MAY						
Replicate Totals						
Number of Individuals	0	0	0	23	60	19
Number of Species	0	0	0	7	5	5
Station Totals						
Number of Individuals		0			101	
Number of Species		0			10	

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* WR-1 was not sampled in May.

Primary Production

Primary productivity was measured in the four lake stations during May using the light and dark bottle method. Differences between light and dark bottles were negligible. This is believed to be because of the short duration of incubation. Additional determinations will be made in the lakes during the next sampling period, at which time bottles will be incubated for a 24-hour period.

Water Quality

Water samples were analyzed for common minerals and nutrients, dissolved oxygen, pH, specific conductance, coliforms, streptococci, and pathogens. In Piceance Creek, total dissolved solids decreased from March to May, probably owing to increased runoff and high flows. Nutrient levels were similar to previous sampling results, indicating little change in the contribution to the total nitrogen level through biological decomposition.

The presence of fecal coliforms and streptococci indicate fecal pollution. Generally, coliform levels were higher in May than in March; in May cattle were again grazing the meadows along Piceance Creek. No pathogenic bacteria were identified during the quarter.

Sediment

Sediment samples were collected from all stations for the first time in May. Analyses were made for percent moisture, total Kjeldahl nitrogen, chemical oxygen demand, and volatile solids. These parameters, in future surveys, will be correlated with biological parameters to investigate the influence of substrate conditions on the benthic fauna. Results of analyses from the first sampling period are shown in Table II D-7.

Samples are dried prior to analyses and the percentage of moisure is determined. Total Kjeldahl nitrogen (TKN) is a measure of nitrogen components of biological origin. It does not measure nitrate or nitrite nitrogen. Chemical oxygen demand (COD) determines a measure of the oxygen equivalent of that portion of the organic matter in a sample that is susceptible to oxidation by a strong chemical oxidant. Volatile solids is a measure of the amount of volatile organic matter in the sample. The sediment sample from Upper Willow Lake had the highest level of all parameters examined. Sediment from this station was black, thick mud and considerably different in appearance than samples collected from other stations. Grain size determinations and correlation analyses of sediment data will be included in the next report.

(Text Continued on Page 142)

TABLE II D-7

SEDIMENT SAMPLE ANALYSES (ON A DRY WEIGHT BASIS) FOR PICEANCE, STEWART AND WILLOW CREEKS AND THE WHITE RIVER, MAY 1975

	Results			
Station	% Moisture	% TKN	% COD	% Volatile Solids
P-1	21.6	0.027	0.49	1.7
P-2	23.8	0.019	0.37	1.3
P-3	21.5	0.025	0.86	2.1
P-5	24.3	0.028	0.59	2.0
P-5A	29.8	0.074	0.92	2.6
P-6	27.8	0.035	1.1	2.0
P-7	25.0	0.032	0.72	2.0
UWL	62.6	0.33	5.1	5.1
LWL	22.7	0.037	0.75	2.3
W-1	37.0	0.16	2.2	2.8
W-2	20.7	0.024	0.36	2.0
W-3	27.1	0.081	1.3	2.3
USL	39.8	0.14	2.4	3.7
LSL	25.0	0.073	1.1	2.9
S-1	26.2	0.042	0.70	1.8
S-2	26.1	0.032	0.56	1.2
WR-2	29.5	0.037	0.61	1.8
WR-1	24.9	0.059	0.92	1.9

Station Legend:

P1-7: Piceance Creek
W1-3: Willow Creek
UWL: Upper Willow Lake
LWL: Lower Willow Lake
S1-2: Stewart Creek
USL: Upper Stewart Creek
LSL: Lower Stewart Creek
WR1-2: White River

Analyses Legend:

TKN = Total Kjeldahl Nitrogen
COD = Chemical Oxygen Demand

II D-3 Terrestrial Vegetation Studies

During this quarter the primary objectives have been to refine sampling methods and to begin the collection of productivity data for the 1975 growing season. Methods are described for the herbaceous productivity, shrub productivity, and herbaceous phenology studies.

Herbaceous productivity is being studied using a harvest method of above ground production in the intensive study plots. Net shoot primary productivity for the shrub species is also being estimated using a harvest method. Herbaceous phenology is designed to monitor seasonal growth and development of selected species at each study site. None of these data have been reduced or analyzed; they will be reported at a later date.

II D-4 Dendrochronology and Dendroclimatology

A master chronology[1] was constructed from core samples of *Pinus edulis* (pinyon pine) in the Tract C-b area. It dates the growth increments produced from 1437 A.D. to 1974 A.D. The individual trees sampled, ranged in age from 132 years to 537 years. The age distribution of pinyon pine indicates that it is not an invading species in the area. The frequency of diagnostic growth layers in the chronology implies that the probability of an extreme departure[2] from the mean ten-year interval of precipitation is 1-2%.

A multiple regression analysis (one which compares two or more independent variables against tree-ring width variation) of the standardized tree-ring data demonstrates that treegrowth in areas with high surface runoff is more a function of all the environmental factors affecting tree growth the previous year than strictly winter precipitation.

A linear regression model, (one which compares one independent variable against tree-ring width variation) correlating tree growth and winter precipitation, predicted the past precipitation regime using the precipitation record from Meeker, Colorado. The graph of these values (Figure II D-4) indicates that there are cyclic changes in the climate with a mean periodicity of eleven years or multiples thereof. The abnormally dry and wet winters for the past 537 years were differentiated from the graph.

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[1] A master chronology for tree-ring dates is prepared by synchronizing the widths of diagnostic growth rings for all trees in an area.

[2] Diagnostic growth layers are these tree rings or yearly increments which are, in relation to their neighboring rings, quite narrow, or, in some cases, quite wide.

(Text Continued on Page 144)

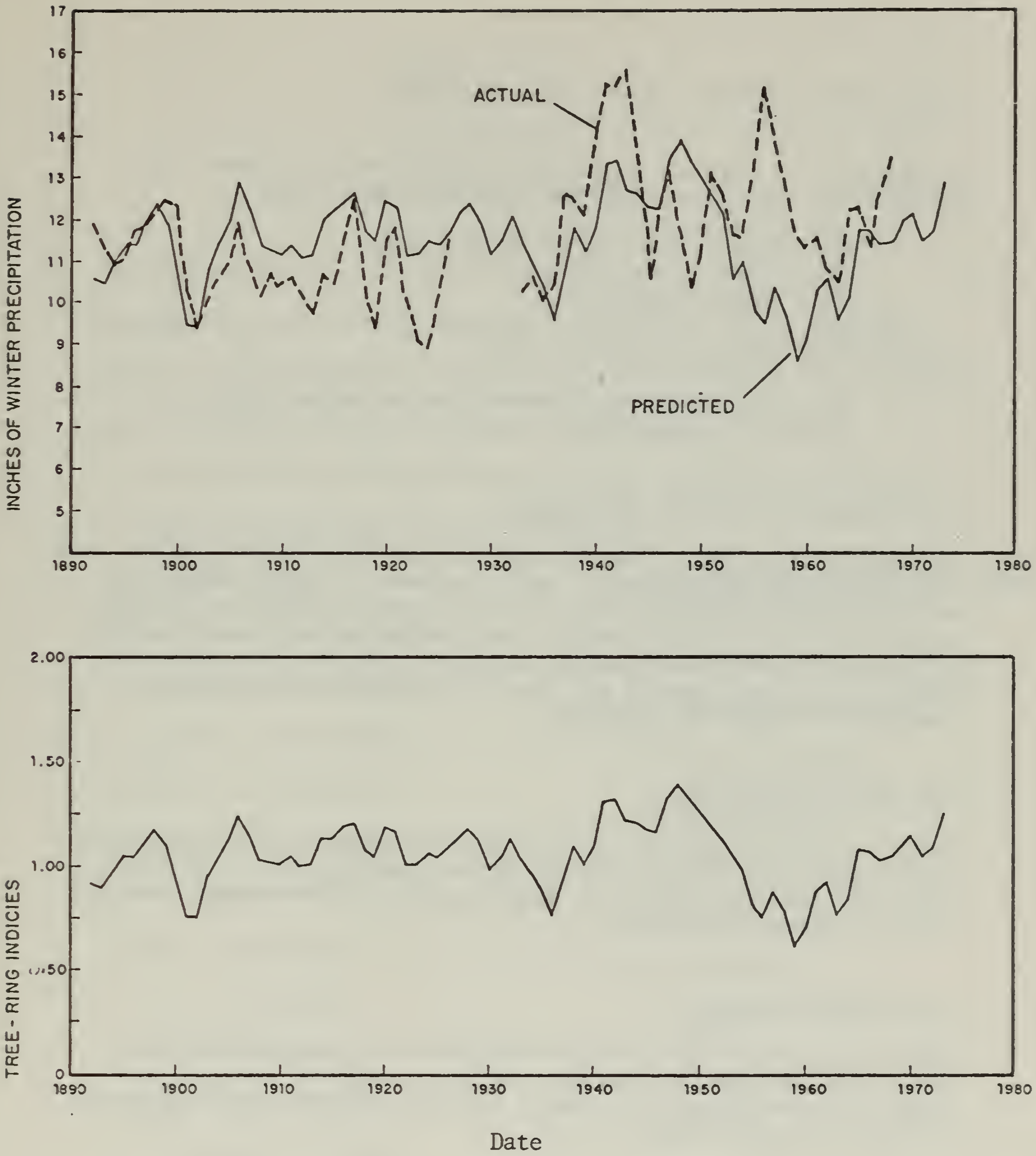


Figure II D-4

Ring-width variation as compared to predicted and actual precipitation for Meeker, Colorado. (Smoothed Data)

II D-5 Soil Survey and Productivity Assessment

As discussed in previous quarterly reports, the soil survey and productivity assessment consists of four related tasks:

1. Soil Mapping and Profile Description;
2. Soil Sample Collection;
3. Soil Chemical Analysis; and
4. Soil Productivity Assessment Studies accomplished in greenhouse facilities.

Soil Mapping and Profile Description

The United States Soil Conservation Service (SCS), under contract with the Bureau of Land Management, has undertaken a project which will map and describe the representative soil type for each soil series occurring in the Piceance Basin. The portion of this area occupied by Tract C-b and the surrounding one-mile study area has been completed. The final mapping and descriptions are expected to be completed by August or September.

Soil Sample Collection

Samples representing major soil horizons from ten soil profiles have been collected from Tract C-b and the surrounding areas. Collection sites were based on SCS survey sample points. These samples are now ready for chemical analysis.

Soil Chemical Analysis

Samples collected from the representative soil types of each soil series occurring in the study area will be analyzed for a suite of chemical characteristics including nutrient elements, trace elements, and toxic minerals (Table II D-8).

Soil Productivity Assessment

Soil obtained from seven sites on Tract C-b (Figure II D-5) was used to determine growth parameters of oats (*Avena sativa* var. *victory*) and barley (*Hordeum vulgare* var. *Briggs*) under greenhouse conditions. Shoot length and biomass data for each species under each treatment were statistically analyzed.

(Text Continues on Page 148)

TABLE II D-8

SCOPE OF WORK

SOIL CHEMICAL ANALYSES

The portion of the Soil Survey and Productivity Assessment assigned to Agricultural Consultants Laboratory is the chemical analysis of soil samples. Said analysis will contain the following characteristics subject to change by Operator.

1) Analysis of samples taken from each soil horizon of the soil type representative of each soil series.

a) organic matter
b) phosphates (available)
c) potassium (available)
d) maganese (available)
e) nitrate (available)
f) sulfate (available)
g) calcium (available)
h) iron (available)
i) boron (available)
j) zinc (available)
k) copper (available)
l) exchangeable sodium
m) magnesium (available)
n) pH
o) ammonia (available)
p) electrical conductivity
r) sodium absorption rate (SAR) (calculated)
s) cation exchange capacity
t) gypsum (calculated)
u) lime (available)
v) molybdenum
w) sodium
x) cobalt
y) selenium
z) arsenic
aa) fluoride
bb) nickel
cc) lead
dd) chloride
ee) mercury
ff) cadmium
gg) antimony

TABLE II D-8 Cont.

hh) textural analysis

ii) bulk density

jj) field capacity and wilting point
(1/3 Bar and 15 Bar)

2) Analysis of samples taken from the representative soil type of each soil series.

a) background alpha and beta radioactivity

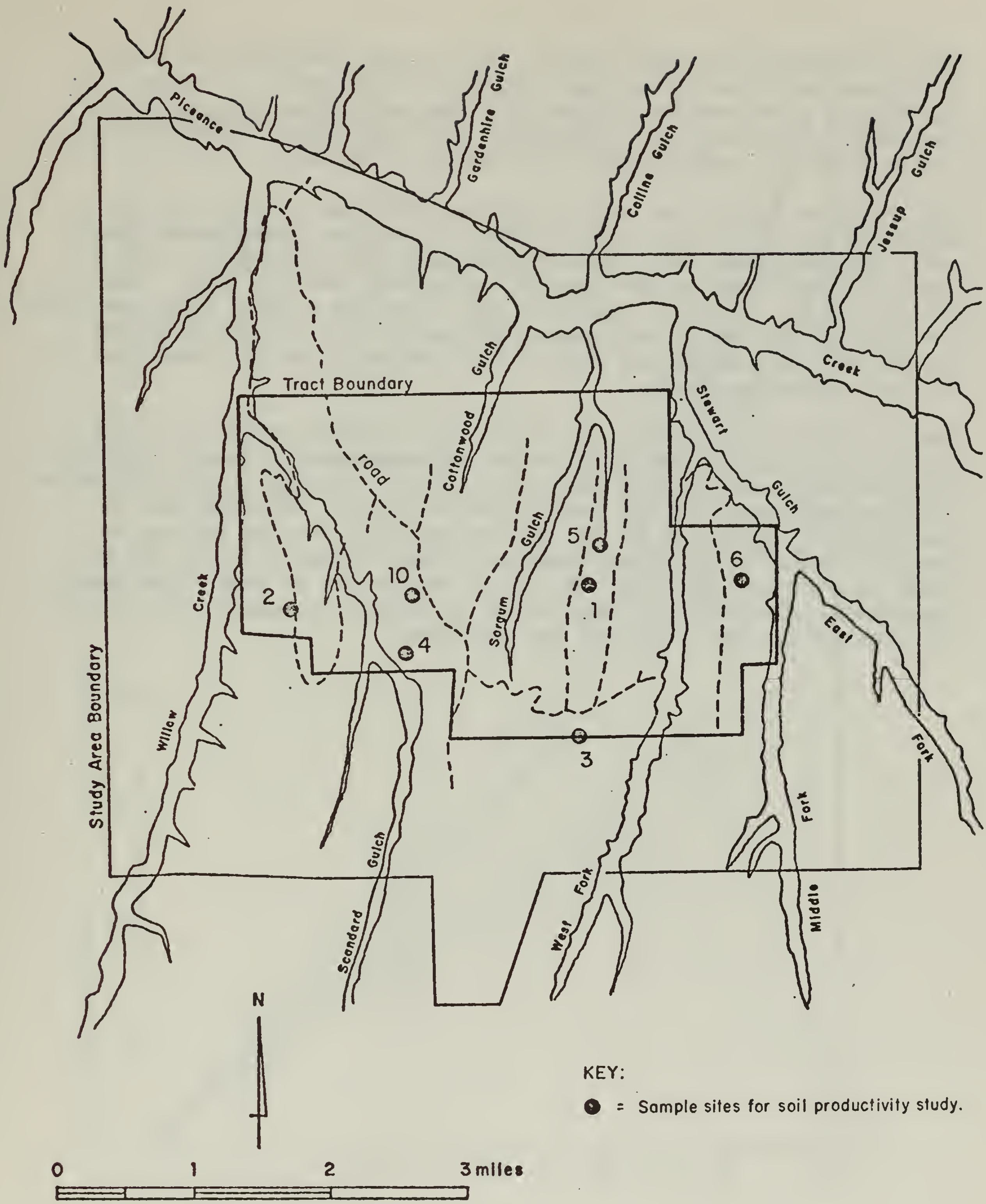


Figure II D-5
Soil productivity sample sites.

Soils collected from sites 2 and 10 are the most productive in terms of biomass and total shoot length, (Figures II D-6 and 7). Soils from sites 1, 3, 4, 5, and 6 are essentially one population with low productivity. No significant correlation was found between nutrient levels in the soils and productivity of the bioassay species.

NO_3 levels in soils 2 and 10 are three to five times higher than NO_3 levels in the other soils (Table II D-9). In addition, phosphorous levels while low throughout the Tract are relatively high in samples 2 and 10. Two additional patterns are apparent in the soil analysis data. They are: 1) the SO_4 levels in samples 2 and 10 are two to five times lower than the other sites; and 2) the electrical conductivity test for salts indicates the salt content of samples 2 and 10 are up to two times that of the less productive soils.

The relatively higher salt content and lower sulphur content of soils 2 and 10 are generally considered to be disadvantageous. These conditions are apparently countered by the higher level of NO_3 and slightly increased level of phosphorous in the more productive soils. The high level of available NO_3 appears to be the most important difference between the Tract C-b soils in the areas around soil sample sites 2 and 10 and the other five sites. Since the NH_4 levels are similar at most sites, larger populations of nitrifying bacteria may be present at sample sites 2 and 10, thus making high increased NO_3 available.

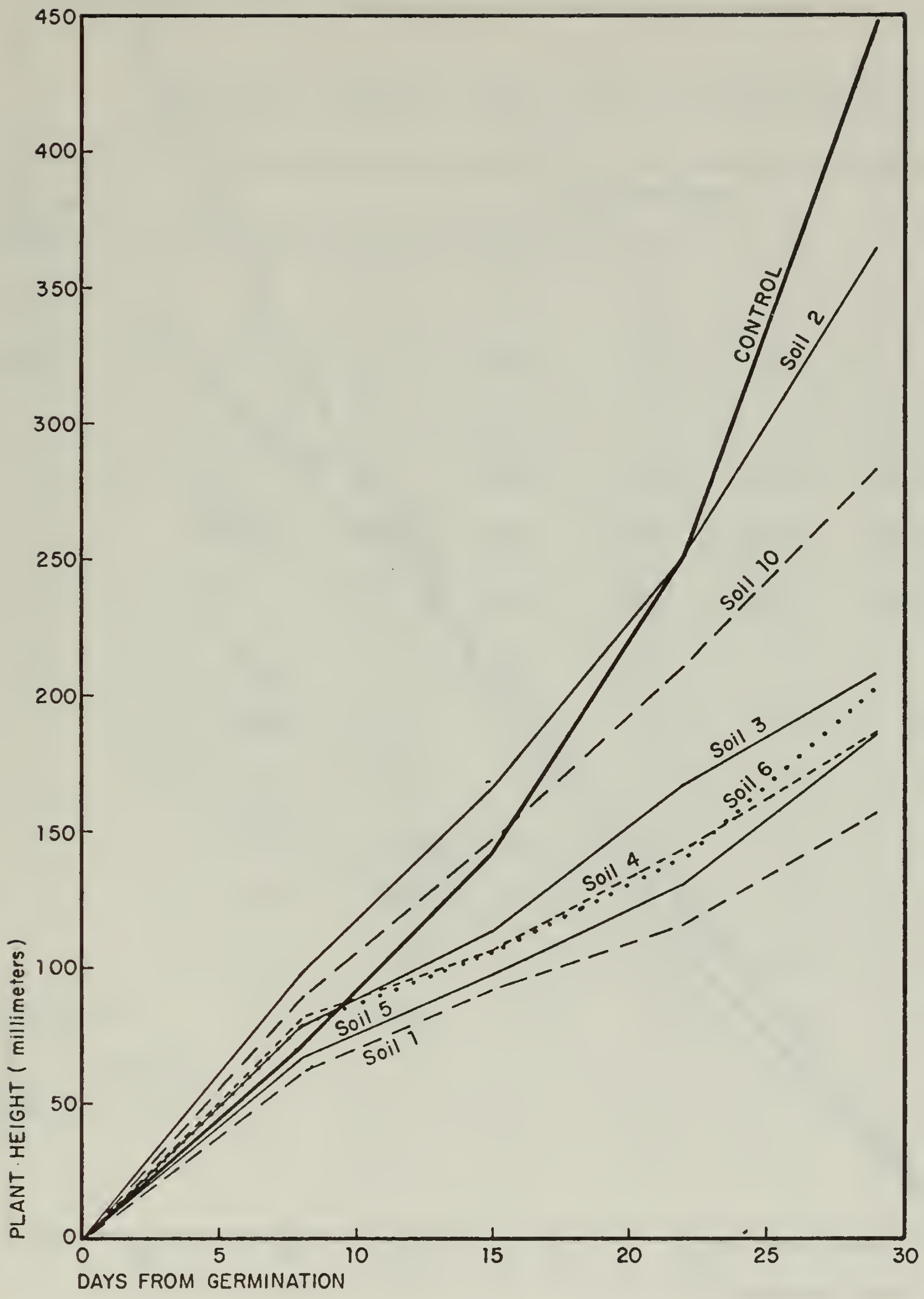


FIGURE II D-6
Growth of *Avena sativa* var. Victory

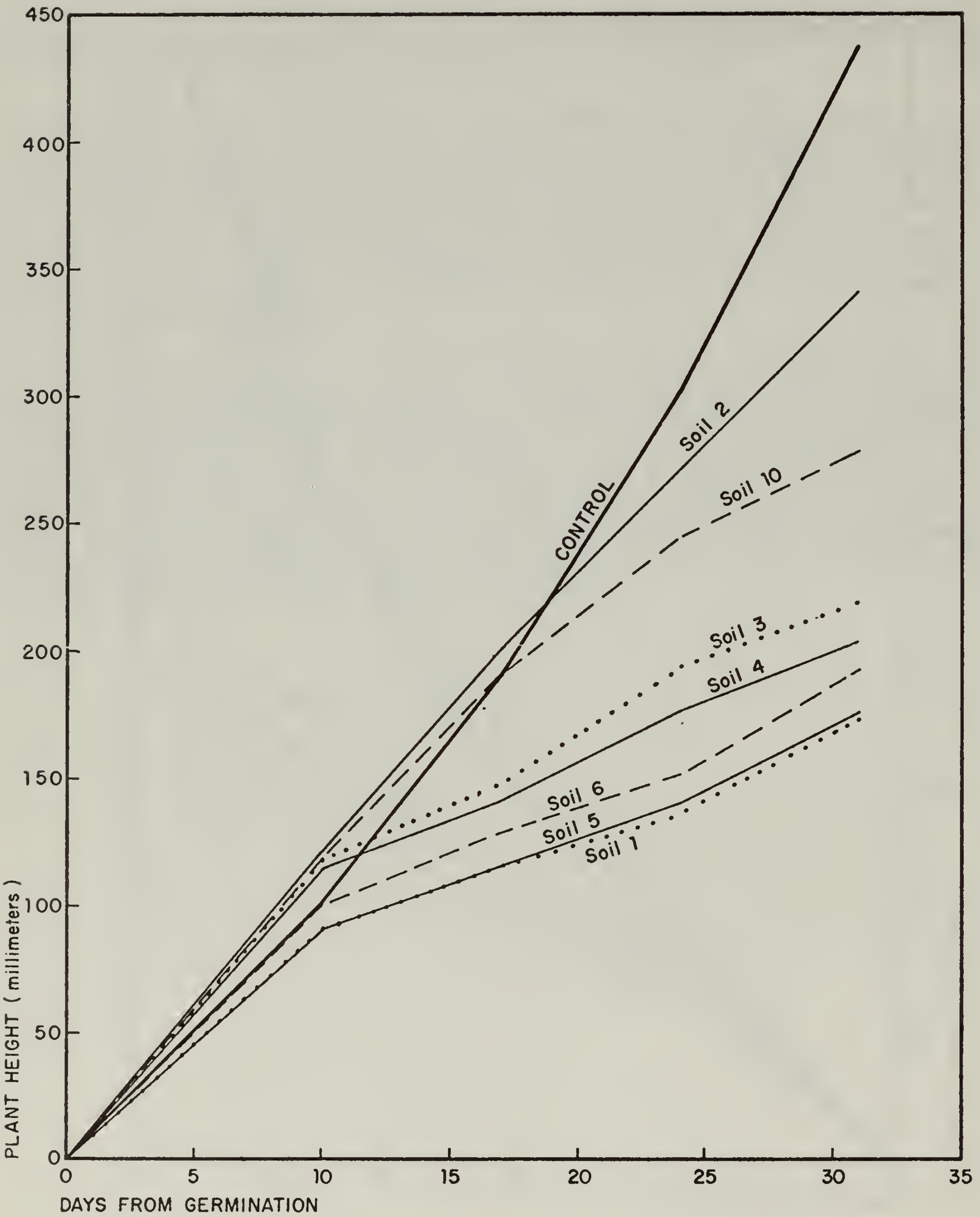


FIGURE II D-7
Growth of Hordeum vulgare var. Briggs

TABLE II D-9

NUTRIENT ANALYSIS OF SEVEN SOIL SAMPLES FROM TRACT C-b

Nutrients (ppm)	Soil Samples 1	2	3	4	5	6	10
NO_3-N	5	27	6	10	7	7	38
NH_4-N	28	39	18	23	38	36	46
P	6	26	16	2	7	24	30
K	120	130	250	300	130	220	490
Ca	4900	2900	2600	3400	4200	2600	4100
Mg	200	380	550	230	290	410	340
SO_4-S	17	6	37	10	27	14	5
Fe	5.2	10.0	7.2	2.6	9.7	29.0	6.6
Zn	0.5	0.4	0.5	0.2	0.5	3.6	1.3
Cu	0.7	0.3	0.8	0.5	0.5	1.3	0.7
Mn	1.0	1.9	3.7	0.9	1.4	9.6	2.5
B	0.5	0.8	0.8	0.9	0.5	0.6	1.2
SALTSEC$\times10^3$	0.28	0.47	0.27	0.31	0.32	0.29	0.58
Water - Holding Capacity, 15 BAR	11	10	14	10	16	18	17

III

OTHER STUDIES

III A FISH AND WILDLIFE MANAGEMENT PLAN

During this quarter, a conceptual draft outline of the Fish and Wildlife Management Plan for Tract C-b was prepared. This conceptual outline basically sets forth the general strategy of the Plan. Information resulting from more than six months' baseline studies, the Lease Environmental Stipulations, and other resource materials have been used in the preparation of this outline of the Plan.

The general goals of this Plan have been identified as follows:

1. To enhance the positive impacts resulting from development and production operations;
2. To minimize the negative impacts resulting from development and production operations;
3. When enhancement and minimization together fall short of fully compensating for adverse negative impacts on fish and wildlife resources and their users, to mitigate, with the objective of further compensating for such impacts; philosophically, mitigation will be planned to take place as close to Tract C-b as feasible; and,
4. To continue to provide public access to Tract C-b, for both harvest and non-harvest uses of fish and wildlife resources, where such use is compatible with operations.

Examination of the results of the Biological Baseline Studies to date, in light of these general goals, has led to the identification of several distinct anticipated problems, for which specific management recommendations are being prepared. Among these problems are the following:

1. The general problem of alteration of habitats through surface modification, such as plant construction and processed shale disposal;
2. The general problem of disposal of toxic chemicals such as fluorides from ground waters removed from the overburden during development and operations;

3. The general problem of effects of mine dewatering upon bottomland habitats;
4. The general problem of negative impacts upon populations of fish and wildlife species which are of interest as possibly being endangered, rare, peripheral, or blue-listed, even if only regionally;
5. The more specific problem of negative impacts upon birds of prey and carnivorous mammals; and
6. The specific problem of negative impacts upon the mule deer, and upon man's uses of the mule deer.

This general Fish and Wildlife Management Plan for Tract C-b provides for the development of a series of operating plans (e.g. five-year plans), commencing immediately. Both the general and operating plans are subject to continual revision, based on consideration of the results of the monitoring studies, and on inputs resulting from review by agencies and the public.

This Plan, in addition to meeting the Lease Environmental Stipulations, also will take into consideration the Colorado Division of Wildlife's 1974 "Strategic Plan for the Comprehensive Management of Colorado's Wildlife Resource," the Bureau of Land Management's statement of May 1975 on "Development of Energy Minerals in Northwest Colorado," and to the extent known at present, the emerging Interagency Plan for Wildlife Management in the Piceance Basin, scheduled for completion by late 1975.

III B REVEGETATION PROGRAM

During the third quarter an outline of procedures for revegetation activities and for evaluation of program success, and a set of general treatment methodologies for use in the revegetation of areas disturbed during the Exploration Phase have been prepared. This information is included in the data section of the third quarterly report. During the fourth quarter specific plans will be prepared for each disturbed site. These plans are to be implemented in the field during the appropriate planting seasons. The revegetation of processed shale will be discussed in our Detailed Development Plan submission this Fall.

OUTLINE

PROCEDURES FOR REVEGETATION ACTIVITIES AND FOR EVALUATION OF PROGRAM SUCCESS

A. Revegetation Criteria

1. Landscape stabilization, designed to prevent and/or minimize erosion created by activities.
2. Support of wildlife population in numbers and kinds as indicated by fauna baseline data.

B. Proposed Course of Action

1. Preparation of generalized revegetation plans and schedules based on accepted techniques. This includes developing seed bed preparation methods; planting methods; mulching and fertilization guidelines; planting season guidelines; seed lists and seed sources.
2. Development of specific practices by field investigation of areas to be revegetated. Specific plans will be prepared by applying the physical evaluation of each site to the generalized procedures.
3. Developing an interface between baseline data and revegetation practices inorder to establish goals for revegetation projects in terms of wildlife population support. Specifically, this involves data gathered for shrubby and herbaceous vegetation; wildlife populations and wildlife utilization; and soil fertility data. The more critical types of data from the above listing will form the parameters for showing what level of success has been attained in replacing habitat. These critical data are Importance Value (which is developed from relative density, frequency, and cover) soil fertility and available forage and/or browse.
4. Formalizing a reporting schedule and format which will contain the following categories of information:
    a. Vegetation, Wildlife, and Soils baseline data for each type of habitat in which a revegetation program has been initiated.
    b. Details of revegetation procedures carried out in each habitat type, with site specific information included where applicable. Details to include methods used in preparing seed bed and planting of seed; amounts of seed and fertilizer; and type of mulch.
    c. Results of periodic analyses, including seed success, amount of available forage; and Importance Value of major species. These data would be submitted for each site within each major habitat.

d. Reporting would be accomplished on an annual basis. Statements will be made at these times regarding trends which the evaluations might reveal. The existence of a strongly directional trend which indicates that a habitat is trending toward its original state is, in essence, an indication of rehabilitation success. These trends will be identified and supported by baseline successional studies. This approach is necessary as a practical approach to the evaluation of the Revegetation/Rehabilitation Program. Plant communities may require many years to fully revert to a previous configuration, whereas the trend toward this state may be established early in the course of these events.

GENERAL TREATMENTS AND PROCEDURES

A. Phase I: Surface Disturbance

1. All sites will be prepared by returning the surface to its nearly original topographic configuration.

2. All sites will be ripped or scarified.

3. Topsoil or subsoil material will be spread on sites when available and if required. Soils and subsoils will be analyzed for nitrogen, phosphorous, potassium, and pH in order to determine fertility and the necessity for topsoiling and/or fertilization.

4. Those sites which are expected to receive high grazing pressures will be fenced with two-strand barbed wire. Other areas will be fenced if grazing pressures prove to be excessive.

5. Water-bars and other erosion checking devices will be used on sites which are adjacent to or intersected by drainage courses, or where surface run-off is great.

6. Species to be seeded will be determined for each site.

7. Amounts of seed per species will be determined using the pure, live-seed method.

8. Seed will be drilled or broadcast; the latter is the preferred method and is believed to favor natural successional events. Drilling seed produces an unnatural distribution pattern and allows the invasion of aggressive species (particularily annuals) into the inter-row areas.

9. Amount of seed will vary from 25 lbs. (broadcast) to 10 lbs. (drilled).

10. Sites will be mulched when broadcast. On all sites available slash will be placed to help prevent dessication.

B. Phase II: Processed Shale Disposal

(To be completed by Detailed Development Plan submission)

Table III B-1

PLANTING PLAN

SITE DESCRIPTION & LOCATION Core hole SG-18,18a; head of Sorghum Gulch; Plateau Sagebrush; off-tract

PLANTING DATE October, 1975

SEEDBED PREPARATION Roughed; Seed drilled

MULCHING TREATMENT None

OTHER SURFACE TREATMENT None

FERTILIZER None

FENCING Expected grazing pressure high; two-strand barbed wire

REMARKS This pad will be monitored and is intersected by a roadway; fencing will have to accomodate traffic to and through pad

SPECIES LIST & RATE

COMMON NAME	SCIENTIFIC NAME	%GERM.	%PUR.	LBS/ACRE
Intermediate wheatgrass	Agropyron intermedium	91	89	3
Siberian wheatgrass	Agropyron sibiricum	96	98	2
Western wheatgrass	Agropyron smithii	80	80	3
Indian ricegrass	Oryzopsis hymenoides	50	90	1

TOTAL LBS./ACRE 9

III C MICROENVIRONMENTAL STUDIES

Four, continuous-recording, microenvironmental stations and 17 relocateable, spot-check stations are in operation on Tract C-b and the surrounding one-mile area. The operation of these stations and the parameters measured at various sites have been described in Quarterly Reports #1 and 2 and in Summary Reports #1 and 2.

No data have been summarized and analyzed for these sites; however, raw data for measured parameters are included in Quarterly Report #3. No extensive interpretations of these data will be made until a greater range of data is available. The purpose of these data is to provide information concerning the growth environment for the revegetation program and to supply environmental data to be used in the gradient analysis portion of the Terrestrial Vegetation Studies. As such these data only become meaningful when there is enough information from all involved programs to allow comparison and correlation.

III D AERIAL PHOTOGRAPHIC STUDY

The scope of the Aerial Photography Program has been presented in Quarterly Reports #1 and #2 (Summary Report #1 and #2). There are no further activities to report in this program at this time. A flight is planned for this growing season and will be reported when the data become available.

III E ARCHAEOLOGICAL STUDIES

The Final Report, "Cultural and Paleontological Resources - Federal Oil Shale Lease Tract C-b", is included in Quarterly Report #2. At this time, no additional archaeological work is planned, with the exception of the reconnaissance studies being performed in all areas which are planned for surface disturbance during the Exploration Phase, and potential test-excavations which might prove necessary in the event that sites identified in the Final Report should be planned for disturbance.

III F SCENIC VALUES PROGRAM

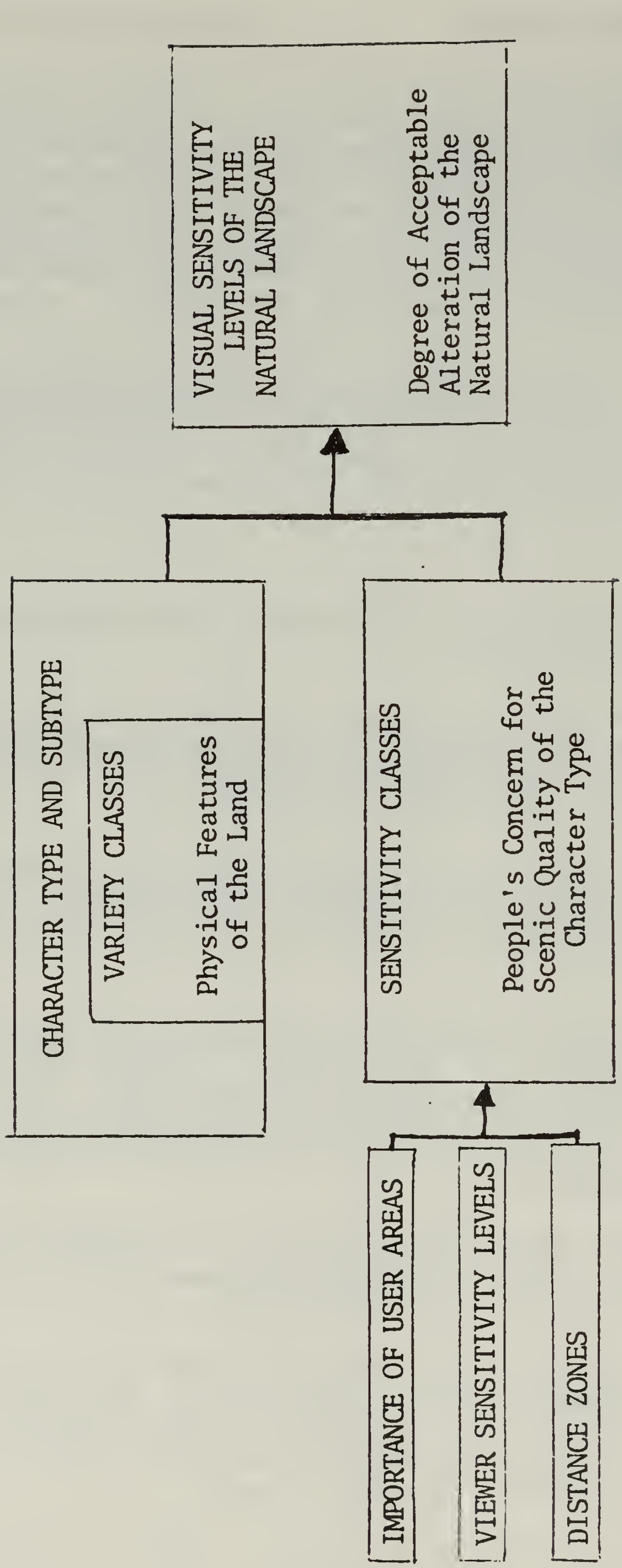
A formal Scenic Values Program is now being conducted in-house by the C-b Shale Oil Project. The objectives of this study are to characterize the scenic elements of the Tract, both as they relate specifically to the Tract and as they are related to the overall scenic resources of the surrounding area; and to define and evaluate areas of visual sensitivity on the Tract on the basis of potential impact of proposed development, and to make recommendations for minimizing this impact.

The methodology to be utilized is a modification of the U.S. Forest Service Visual Management System (National Forest Landscape Management, Volume 2, Chapter 1 - "The Visual Management System;" U.S.D.A. Handbook #462) as illustrated in Figure III F-1. This study will produce a map which indicates the Visual Sensitivity Levels of the area studied (Tract C-b area).

The following considerations are involved in the preparation of the Visual Sensitivity Levels map:

1. Character Type of the region - defined as an area of land that has common physiographic and geomorphic characteristics used as a frame of reference to classify physical features of subunits which occur within the region.
2. Character Subtypes - defined divisions of the region which differ significantly in visual characteristics; used as a frame of reference to classify physical features of the study area. (Tract C-b)
3. Variety Classes (Distinctive, Common, and Minimal) which occur within the Piceance Basin Subtype - based on features such as rockform, landform, vegetation, and water forms; used to identify those landscapes within the Tract C-b area which are most important and those which are of lesser value from the standpoint of scenic quality;
4. Sensitivity Classes which account for the human factors related to scenic quality. Those factors considered in defining Sensitivity Classes are listed below:
    a. Importance of User Areas in the Tract C-b area - based on evaluation of all travel routes, use areas, and water bodies within or adjacent to the study area as either of primary or secondary importance, primarily with respect to relative intensity of use;
    b. Viewer Sensitivity Levels - based on an evaluation of whether users have major or minor concern for the scenic quality of the area; and

FIGURE III F-1


CHARACTER TYPE AND SUBTYPE
VARIETY CLASSES
Physical Features of the Land
SENSITIVITY CLASSES
People's Concern for Scenic Quality of the Character Type
IMPORTANCE OF USER AREAS
VIEWER SENSITIVITY LEVELS
DISTANCE ZONES
VISUAL SENSITIVITY LEVELS OF THE NATURAL LANDSCAPE
Degree of Acceptable Alteration of the Natural Landscape

c. Distance Zones - define the degree of visibility of the study area from travel routes, use areas, and water bodies - based on a field check of whether the study area is visible and an identification of the Distance Zone of the visible portion of the Tract C-b area as foreground, middleground, or background from each vantage point or travel route identified.

The map of Visual Sensitivity Levels of the Tract C-b area will be used to provide a means by which aesthetic values may be considered in "all planning, construction, reclamation and mining operations" and to "minimize visual impact" as required by the Oil Shale Lease Environmental Stipulations. This will be accomplished by using the map during planning phases to indicate the relative Visual Sensitivity of various areas proposed for the location of development activities. Recommendations will be made as to the most visually acceptable locations for the development activities proposed. In the event that development activities must take place in areas of relatively high visual sensitivity, design criteria will be developed which will minimize the visual impact of the activity. The relative Visual Sensitivity Level of the area proposed for development will determine the degree of design modification necessary to minimize visual impact.

Form 1279–3
(June 1984)

BORROWER

TN 859 .C64 C3747
C-b Shale Oil Proj
Tract C-b: summary

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